

# **Service Manual**

**Tektronix**

**TPG20  
Test Pattern Generator**

**070-9035-00**

**Please check for change information at the rear  
of this manual.**

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For further information, contact: Tektronix, Inc., Corporate Offices, P.O. Box 1000, Wilsonville, OR 97070-1000, U.S.A. Phone: (503) 627-7111; TLX: 192825; TWX: (910) 467-8708; Cable: TEKWSTG.

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## Contents

# Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* before performing any service procedures.

## Safety Terms and Symbols

### Terms in This Manual

These terms may appear in this manual:



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**WARNING.** Warning statements identify conditions or practices that could result in injury or loss of life.

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**CAUTION.** Caution statements identify conditions or practices that could result in damage to this product or other property.

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### Terms on the Product

These terms may appear on the product:

**DANGER** indicates an injury hazard immediately accessible as you read the marking.

**WARNING** indicates an injury hazard not immediately accessible as you read the marking.

**CAUTION** indicates a hazard to property including the product.

### Symbols on the Product

The following symbols may appear on the product:



DANGER  
High Voltage



Protective Ground  
(Earth) Terminal



ATTENTION  
Refer to  
Manual



Double  
Insulated

## To Avoid Fire or Shock Hazards:

<b>Do Not Service Alone</b>	Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.
<b>Avoid Exposed Circuitry</b>	Before servicing, remove jewelry such as rings, watches, and other metallic objects. Disconnect power before removing protective covers, replacing components, or soldering. Test before touching exposed connections and components when power is present.
<b>Use Proper Power Cord</b>	Use only the power cord set provided with this product, or some other properly rated and approved cord set configured for the local mains supply outlets.
<b>Use Proper Power Source</b>	This product is designed to operate from a power source that will apply no more than 250 V <sub>RMS</sub> between the supply conductors, or between either supply conductor and ground.
<b>Ground the Product</b>	Before connecting the product's input or output terminals, plug the power cord into a properly wired receptacle. A protective ground connection, through the grounding conductor in the power cord, is essential for safe operation.
<b>Use Proper Fuse</b>	Use only the fuse type and rating specified for this product.
<b>Observe All Ratings</b>	Observe and follow all ratings and markings on the product. Consult the product's manual for further ratings information before making any connections to the product.
	This product is intended to be connected to products with their common at ground potential. Do not connect to elevated or floating common voltages.
<b>Battery Replacement</b>	Replace batteries only with the proper type and rating specified. Refer to the instructions in the manual for details on battery replacement.  Note: Batteries should always be discarded in accordance with all local regulations.
<b>Provide Proper Ventilation</b>	Refer to the manual's installation instructions for details on installing the product so that it has adequate cooling ventilation.
<b>Use in Proper Environment</b>	Do not operate this product in wet/damp locations or conditions. This product is not designed for use in an explosive atmosphere.

# Preface

This manual provides a limited set of service information for the TEKTRONIX TPG20 Test Pattern Generator and is intended for use by personnel who are qualified to work inside the instrument. There is a separate manual that is included with the instrument which provides operating instructions for the generator.

The preface describes the contents of this service manual, and includes a brief description of each section within the manual.

The Table of Contents is a detailed list of the sections, and the major divisions within them. There are also lists showing the locations of illustrations and of tables.

Section 1 contains the Performance Check and Calibration procedures, along with a list of equipment required to complete them. The Performance Check procedure is used to determine whether the instrument is performing within its specifications, while the Calibration procedure shows how to perform the adjustments necessary to restore the TPG20 to its specified operation.

Section 2 contains the Replaceable Parts List. Unlike most of our Replaceable Parts Lists, the TPG20 Parts List combines electrical and mechanical parts in one list. Nomenclature and ordering processes are different than normal for Tektronix products, as well. Contact your TEKTRONIX representative regarding replacement parts.

Section 3 contains the schematic diagrams, and an illustration of the Test Pattern Generator board showing the location of all the components.

At the end of the manual there may be a tabbed page titled Manual Change Information. Any pages following this tabbed page will contain the latest changes and corrections to the instrument.





# Section 1



# Section 1

## Performance Check and Calibration Procedures

This section consists of two separate procedures. The first, a Performance Check, is used to determine compliance with the Performance Requirements in the Specification. The Performance Check is followed by a Calibration Procedure, which provides adjustment instructions intended to return the instrument to its original operating performance following repairs or a routine maintenance program.

In both procedures, front- and rear-panel controls and connectors for the instrument under test are fully capitalized (e.g., VARIABLE GAIN). Control and connector names on test equipment and internal adjustments for the instrument under test are initial capitalized (e.g., Time/Div, Geometry, etc.).

Limits, tolerances, and waveforms given in this section are guides to adjustments and checks, and are not instrument specifications unless they are listed as Performance Requirements in the Specification.

### Recommended Equipment List

The following equipment is recommended for use in the Performance Check and Adjustment Procedures for this instrument. Other equipment may be substituted; however, care must be used to ensure that the accuracy of the substituted equipment does not compromise the results of a particular procedure step.

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***NOTE.** Using the equipment in the Recommended Test Equipment list, an accuracy ratio of 4:1 or better for warranted measurement specifications will be obtained, with the following exceptions:*

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<i>Amplitude Accuracy is</i>	<i>2:1</i>
<i>Linearity and Dif Gain are</i>	<i>2.5:1</i>
<i>Diff Phase is</i>	<i>1.6:1</i>

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### Electrical Instruments

#### 1. Video Measurement set

For example: a TEKTRONIX VM700A Opt 1, Opt 11 (Firmware Version 2.6 or later).

**2. Test Oscilloscope**

Vertical Amplifier: 30 MHz Bandwidth, 1 mV Sensitivity.

Time Base: 10 ns/div to 5 ms/div sweep speeds, triggering to 5 MHz.

For example: a TEKTRONIX TAS 465 Oscilloscope. Also 10X probes, P6106 (Tektronix Part No. 010-6106-03), and a 1X probe, P6101 (Tektronix Part No. 010-6101-03).

**3. Television Signal Generator**

To provide color test signals for the television standards which will be tested.  
Must be capable of Genlocking to an input signal, and have a subcarrier output.

For example:

NTSC – TEKTRONIX TSG-170A Test Signal Generator.

PAL – TEKTRONIX TSG-271 Test Signal Generator.

**4. Digital Waveform Monitor**

Capable of accepting Parallel Digital input for the television standards which will be tested.

For example:

NTSC – TEKTRONIX 1730D Digital Waveform Monitor

PAL – TEKTRONIX 1731D Digital Waveform Monitor

**5. Analog Vectorscope/Waveform Monitor**

For example:

NTSC – TEKTRONIX 1780 Video Measurement Set

PAL – TEKTRONIX 1781 Video Measurement Set

**6. Spectrum Analyzer with Tracking Generator**

Bandwidth  $\geq$  10 MHz and sensitivity to 50 dB.

For example: TEKTRONIX 2712 Opt 04

**7. Frequency Counter**

Range: 10 Hz to 135 MHz. Accuracy:  $\pm 0.001\%$ . Ratio architecture.

For example: Tektronix DC5009 installed in a TM5000-Series Power Module.

**8. Video Amplitude Calibrator**

Signal, adjustable square wave 0.0 to 999.9 mV p-p with a resolution of 0.1 mV and an accuracy of 0.05%; frequency approximately 270 Hz.

For example: TEKTRONIX 067-0916-00 in a TM5000-Series Power Module.

**9. Serial Digital Component Waveform/Vector Monitor**

Capable of accepting and displaying component format serial digital television signals.

For example: TEKTRONIX WFM601i

**10. Personal Computer**

For example: IBM Compatible, 286 or better. Must have a Centronics parallel port and an RS-232 port, and must have terminal emulation software.

**11. RF Bridge**

Range: At least 46 dB return loss sensitivity, 50 kHz to 10 MHz.

For example: Wideband Engineering Part No. A57T, with high-frequency terminator A56T75B.

## Auxiliary Equipment

**12.  $75\Omega$  Terminators**

For example:

$75\Omega$  End-line Terminations, 26 dB to 300 MHz (Tektronix Part No. 011-0163-00).

$75\Omega$  End-line Termination (Tektronix Part No. 011-0102-00).

$75\Omega$  Feed-through Termination (Tektronix Part No. 011-0103-02).

**13. Coaxial Cable**

Three  $75\Omega$  cables required, two  $50\Omega$  cables required.

For example:

$75\Omega$  – 42-inch (Tektronix Part No. 012-0159-00).

$50\Omega$  – 42-inch (Tektronix Part No. 012-0057-01).

**14.  $50\Omega$  to  $75\Omega$  Minimum Loss Attenuator (DC Coupled)**

For example: Tektronix Part No. 011-0057-01.

**15. Dual Input Coupler, BNC**

For example: Tektronix Part No. 067-0525-02.

**16. Centronics Parallel cable**

For example: Tektronix Part No. 175-3671-00.

**17. 9-pin RS-232 cable**

# Performance Check

## 1. Visual Inspection

- a. Connect the TPG20 to a power source, and turn the power on.
- b. **Check** – the front panel LCD contrast. The readout should be easily visible under normal lighting conditions.
- c. **Check** – all front panel controls, indicators and rear panel connectors for functionality, appearance, and mechanical integrity.

## 2. Subcarrier Accuracy

**NOTE.** After initial delivery or long storage allow a two-hour warm up to re-age the crystal. Thereafter, 30 minutes warm up is sufficient.

### NTSC 3.579545 MHz $\pm$ 2 Hz

#### a. Set TPG20:

FORMAT – 525/60 COMPOSITE NTSC/D2

Groups; FLAT FIELDS; BLACK 525 NTSC/D2

(See Figure 1–1)

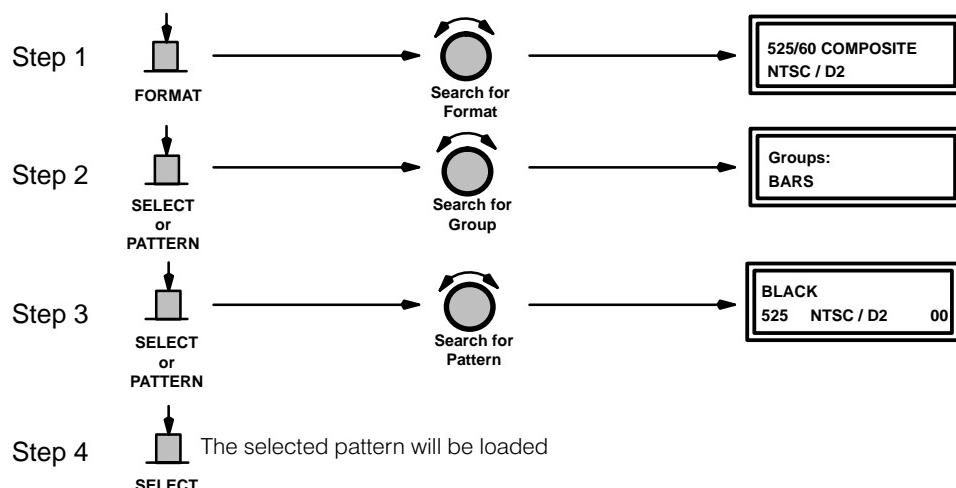


Figure 1–1: Basic steps to set the TPG20 output pattern

- b. Connect the equipment as shown in Figure 1–2, using the TSG–170A and 1780R.
- c. Verify the presence of a standard NTSC Black Burst signal with the waveform monitor.
- d. Set the frequency counter Function to Ratio B/A, and AVG set to  $10^7$ .
- e. **Check** – that the measured frequency is  $3.579545 \text{ MHz} \pm 2 \text{ Hz}$ .

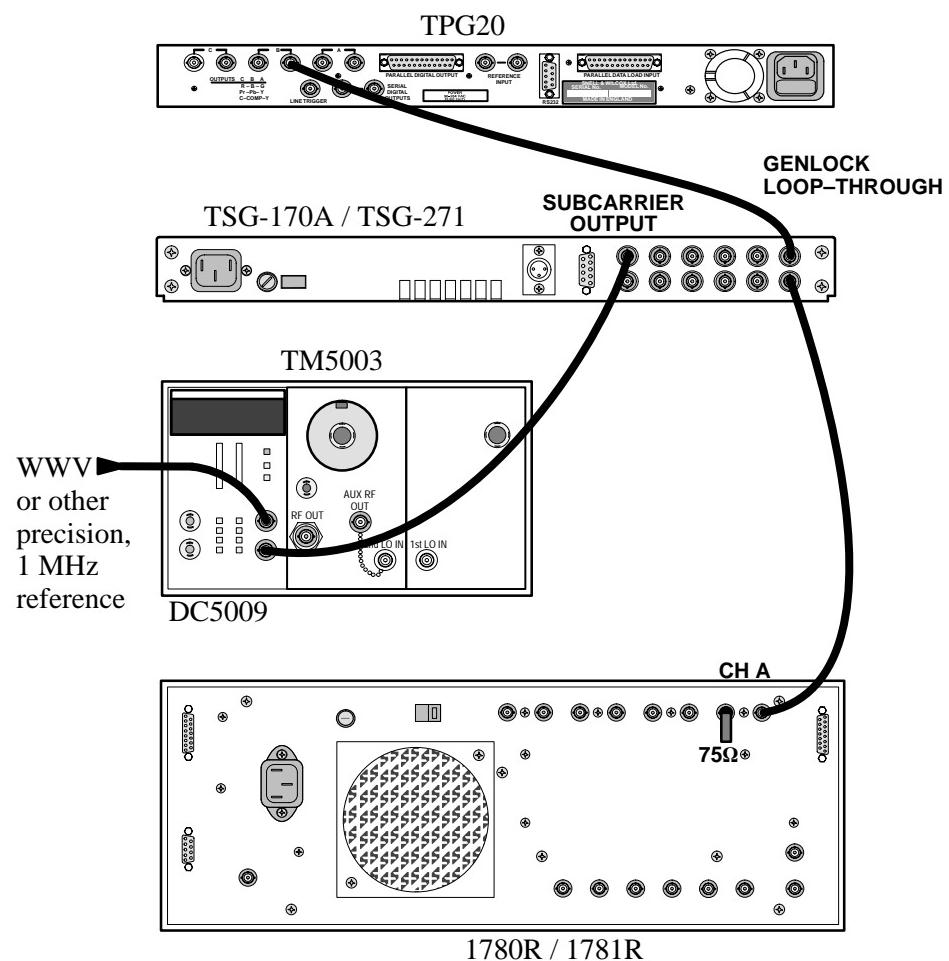


Figure 1–2: Initial equipment connections for checking the TPG20

**PAL 4.43361875 MHz  $\pm$  1 Hz****f. Set TPG20:**

FORMAT – 625/50 COMPOSITE PAL/D2

Groups; FLAT FIELDS; BLACK 625 PAL/D2

- g.** Connect the equipment as shown in Figure 1–2, using the TSG–271 and 1781R.
- h.** Connect frequency counter (referenced to WWV) set to ratio B/A to TSG-271 Sub Carrier Output.
- i.** **Check** – that the measured frequency is 4.43361875 MHz  $\pm$  1 Hz.

**3. Amplitude Accuracy <  $\pm$  1.0% All Analog Output Modes****a. Set TPG20:**

FORMAT 625/50 COMPONENT RGB

Groups: LINEARITY; RAMP 100% 625 RGB

- b.** Use VM700A to check amplitude accuracy of 1.0 V  $\pm$ 1.0% p–p, using the level meter mode (measure position view). Check levels out of all six TPG20 Analog Outputs (both A Outputs, both B Outputs, and both C Outputs).

**c. Set TPG20:**

FORMAT 525/60 COMPONENT RGB

Groups; LINEARITY; RAMP 100% 525 RGB

- d.** Use VM700A to check amplitude accuracy of 1.0 V  $\pm$ 1% p–p, using level meter mode.

Check levels out of all six TPG20 Analog Outputs (both A Outputs, both B Outputs, and both C Outputs).

**e. Set TPG20:**

FORMAT 525/60 COMPOSITE NTSC D2

Groups: LINEARITY; RAMP 100% 525 NTSC

- f.** Use VM700A to check for a composite video signal of 1.0V  $\pm$ 1.0% (peak to peak measurement) on both of the TPG20 B Analog Outputs.

**g. Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Groups: LINEARITY; RAMP 100% 625 PAL/D2

- h.** Use VM700A to check for a composite video signal of  $1.0V \pm 1.0\%$  on both of the TPG20 B Analog Outputs.

**i. Set TPG20:**

FORMAT 625/50 COMPONENT D1/YPrPb

Groups: LINEARITY; RAMP 100% 625/50 D1/YPrPb

- j.** Use VM700A to check for a luminance signal of  $1.0V \pm 1.0\%$  on both of the TPG20 A Analog Outputs.

**k. Set TPG20:**

FORMAT 625/50 COMPONENT YPrPb

Groups: LINEARITY; RAMP 100% 625/50YPrPb

- l.** Use VM700A to check for a luminance signal of  $1.0V \pm 1.0\%$  on both of the TPG20 A Analog Outputs.

**m. Set TPG20:**

FORMAT 625/50 COMPOSITE SECAM

Groups: BARS; EBU COLOR BARS 625 SECAM

- n.** Use VM700A to check for a composite video signal of  $1.0V \pm 1.0\%$  on both of the TPG20 B analog outputs. Check for a  $1.0V \pm 1.0\%$  luminance signal on both of the TPG20 A Analog Outputs.

**o. Set TPG20:**

FORMAT 525/60 COMPONENT D1/YPrPb

Groups: LINEARITY; RAMP 100% 525 D1/YPrPb

- p.** Use VM700A to check for a luminance signal of  $1.0V \pm 1.0\%$  on both of the TPG20 A Analog Outputs.

**q. Set TPG20:**

FORMAT 525/60 COMPONENT YPrPb

Groups: LINEARITY; RAMP 100% 525YPrPb

- r.** Use VM700A to check for a luminance signal of  $1.0V \pm 1.0\%$  on both of the TPG20 A Analog Outputs.

- s.** Select TPG20 variable gain and verify that gain can be adjusted over the range of at least +2.5dB to -25.0 dB (as displayed on the TPG20 display). Note that the amplitude changes are visible on the VM700A.

**4. Bandwidth 6.5 MHz  $\pm 0.1$  dB (NTSC and PAL)****a. Set TPG20:**

FORMAT 625/50 COMPONENT RGB

Groups: SWEEPS; LINE SWEEP 6.5 625 RGB

- b.** Using Channel A of the 1781 waveform monitor, check flatness of the swept frequency on all six of the TPG20 Analog Outputs  $\pm 0.1$ dB (equals approximately  $\pm 1.0\%$ ).

**c. Set TPG20:**

FORMAT 525/60 COMPOSITE NTSC/D2

Groups: SWEEPS; LINE SWEEP 6.5 525 NTSC/D2

- d.** Using Channel A of the 1780 waveform monitor, check flatness of the swept frequency on all four of the TPG20 A and B Outputs  $\pm 0.1$ dB (equals approximately  $\pm 1.0\%$ ).

**5. Linearity Error < 1.0%****a. Set TPG20:**

FORMAT 525/60 COMPOSITE NTSC/D2

Groups: LINEARITY; STAIRCASE – 5 525 NTSC/D2

- b.** Test both B Analog Outputs on the TPG20 using the VM700A luminance nonlinearity measurement mode. Linearity error < 1.0%.

**c. Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Groups: LINEARITY; STAIRCASE – 5 625 PAL/D2

- d.** Test both B Analog Outputs on the TPG20 using the VM700A luminance nonlinearity measurement mode. Linearity error < 1.0%.

**6. Differential Gain < 0.75%****Differential Phase < 0.5°****a. Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Groups: LINEARITY; MODULATED RAMP 625 PAL/D2

- b. Test both B Analog Outputs on the TPG20 using the VM700A DGDP measurement mode. Differential Gain < 0.75% Differential Phase < 0.5°.

- c. **Set TPG20:**

- FORMAT 525/60 COMPOSITE NTSC/D2

- Groups: LINEARITY; MODULATED RAMP 525 NTSC/D2

- d. Test both B Analog Outputs on the TPG20 using the VM700A DGDP measurement mode. Differential Gain < 0.75% Differential Phase < 0.5°.

**7. Trigger Line Select – Trigger Out**

- a. **Set TPG20:**

- FORMAT 525/60 COMPOSITE NTSC/D2

- Groups: BARS: SMPTE COLOR BARS 525 NTSC/D2

- b. Use the oscilloscope to check for a negative going field rate pulse of  $\geq 0.5$  V into  $75 \Omega$ , from the TPG20 TRIGGER OUT connector.
    - c. Look at the TPG20 composite video output (A Analog Output) with the oscilloscope externally triggered by the TPG20 TRIGGER OUT signal.
    - d. Press the TPG20 TRIGGER button. Use the TPG20 knob to select the line to be viewed on the oscilloscope. Verify correct operation by looking for video signals on lines 17, 18, 280 and 281 (VITS). Check both frames 1 and 2.

**8. Genlock NTSC – Horizontal Phase Adjustment  $\pm$ one half line.**

- a. Connect the TSG170A Black Burst signal to the TPG20 REFERENCE INPUT. Connect the other side of the REFERENCE INPUT loop-through to CH 1 on the oscilloscope (terminated into  $75 \Omega$ ).
    - b. Connect one of the Analog B Outputs of the TPG20 to CH 2 of the oscilloscope.
    - c. Trigger the oscilloscope internally on the CH 1 signal.

- d. **Set TPG20:**

- FORMAT 525/60 COMPOSITE NTSC/D2

- Groups: BARS; SMPTE COLOR BARS 525 NTSC/D2

- e. Set TPG20: Genlock to On. Select Lock on: Sync Lock. Verify that genlock occurs within 20 seconds and the Genlock light is on (not blinking).

- f. Select H-PHASE on the TPG20 and rotate knob to verify that horizontal phase can be adjusted at least 63.486 ns ( $\pm$ one half line). Return setting to 0 ns.

#### **9. Vertical Phase Adjustment – 1 Frame – NTSC**

- a. Use same test setup as step 8 except trigger the oscilloscope externally with the TPG20 TRIGGER OUT signal.
- b. Select V-phase on the TPG20 and rotate knob. Verify that vertical phase can be adjusted at least one frame. Return setting to line 1.

#### **10. Subcarrier Phase Adjustment – 360 degrees in steps of 1 degree – NTSC**

- a. Connect the TSG-170A Black Burst signal to the TPG20 REFERENCE Input. Connect the other side of the loop through to the VM700A CH B input.

- b. Connect one of the TPG20 Analog B Outputs to CH A of the VM700A.

##### **c. Set TPG20:**

FORMAT 525/60 COMPOSITE NTSC/D2

Groups: BARS; SMPTE COLOR BARS 525 NTSC/D2

- d. Set TPG20 to Genlock. Lock ON; SC – Phase

- e. Set VM700A to Vector Mode – burst reference to CH B.

- f. Set TPG20 to SC-phase, rotate knob and observe that VM700A vector display is capable of being adjusted over the full 360 degrees. Return SC –phase adjustment to 0.

#### **11. Genlock PAL – Horizontal Phase Adjustment $\pm$ one half line.**

- a. Using the Black Burst signal of the TSG271 – loop through the Reference Input of the TPG20 to CH 1 on the oscilloscope (terminated into  $75\ \Omega$ ).

- b. Connect one of the Analog B Outputs of the TPG20 to CH 2 of the oscilloscope.

- c. Trigger the oscilloscope internally off of CH 2.

##### **d. Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Groups: BARS; EBU COLOR BARS 625 PAL/D2

- e. Set TPG20 Genlock to On. Select Lock on: Sync Lock. Verify that genlock occurs within 20 seconds and Genlock light is on (not blinking).
- f. Select H-phase on the TPG20 and rotate knob to verify that horizontal phase can be adjusted at least  $\pm$ one half line. Return setting to 0 nS.

#### **12. Vertical Phase Adjustment – 1 Frame – PAL**

- a. Use same test set-up as step 11 except trigger the oscilloscope externally from the TPG20 TRIGGER OUT connector.
- b. Select V-phase on the TPG20 and rotate knob. Verify that vertical phase can be adjusted at least one frame. Return setting to line 1.

#### **13. Subcarrier Phase Adjustment – 360 degrees in steps of 1 degree – PAL**

- a. Connect the TSG-271 Black Burst signal to the TPG20 REFERENCE Input. Connect the other side of the loopthrough to the VM700A CH B input.
- b. Connect one of the TPG20 Analog B Outputs to CH A of the VM700A.
- c. **Set TPG20:**  
FORMAT 625/50 COMPOSITE PAL/D2  
Groups: BARS; EBU COLOR BARS 625 PAL/D2
- d. Set TPG20 to Genlock. Lock ON; SC – lock
- e. Set VM700 to vector mode – burst reference to CH B.
- f. Set TPG20 to SC-phase, rotate knob and observe that VM700A vector display is capable of being adjusted over the full 360 degrees. Return SC –phase adjustment to 0.
- g. Switch TPG20 Genlock to off.

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**NOTE.** The only requirement for steps 14 through 19 is to make sure that the selected signal is the one actually output. Verification of signal specifications is not needed at this time.

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#### **14. Check Serial Digital Outputs PAL D2**

- a. **Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Group: BARS; EBU COLOR BARS 625 PAL/D2

Set: D2 Output Serial

- b.** Connect TPG20 SERIAL DIGITAL OUTPUT to 1731D Serial Input and 1731D DAC Out to the 1781, which is set to Video Monitor display. Terminate the loop-through in  $75\Omega$
- c.** **Check** – for correct video signal display on 1731D and 1781.
- d.** Move the cable to the second TPG20 SERIAL DIGITAL OUTPUT and repeat part c.
- e. Set TPG20:**  
PATTERN – Groups: LINEARITY; RAMP 100% 626 PAL/D2
- f. Check** – for correct video signal display on 1731D and 1781.
- g.** Return cable to the first TPG20 Serial Output and repeat part f.

## 15. Check Parallel Digital Output PAL D2

- a. Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Groups: LINEARITY; RAMP 100% 625 PAL/D2

Set: D2 Output Parallel

- b.** Connect TPG20 PARALLEL DIGITAL OUTPUT to 1731D Parallel Digital Input.
- c.** **Check** – for correct video signal display on 1731D and 1781.
- d. Set TPG20:**  
FORMAT 625/50 COMPOSITE PAL/D2
- e.** **Check** – for correct video signal display on 1731D and 1781.

## 16. Check Serial Digital Outputs NTSC D2

- a. Set TPG20:**

FORMAT 525/60 COMPOSITE NTSC/D2

Groups: BARS; SMPTE COLOR BARS 525 NTSC/D2

Set: D2 Output Serial

- b.** Connect TPG20 SERIAL DIGITAL OUTPUT to 1730D Serial Input and 1730D DAC Out to the 1780, set to video monitor display.
- c.** **Check** – for correct video signal display on 1730D and 1780.
- d.** Move the cable to the second TPG20 SERIAL DIGITAL OUTPUT and repeat part c.
- e. Set TPG20:**  
PATTERN – Groups: LINEARITY; RAMP 100% 525 NTSC/D2
- f.** **Check** – for correct video signal display on 1730D and 1780.
- g.** Return the cable to the first TPG20 SERIAL DIGITAL OUTPUT and repeat part f.

#### **17. Check Parallel Digital Output NTSC D2**

- a. Set TPG20:**

FORMAT 525/60 COMPOSITE NTSC/D2

Groups: LINEARITY; RAMP 100% 525 NTSC/D2

Set: D2 Output Parallel

- b.** Connect TPG20 PARALLEL DIGITAL OUTPUT to 1730D Parallel Digital Input.
- c.** **Check** – for correct video signal display on 1730D and 1780.
- d. Set TPG20:**  
FORMAT 525/60 COMPOSITE NTSC/D2
- e.** **Check** – for correct video signal display on 1730D and 1780.

#### **18. Check NTSC 525/60 Component Digital Serial**

- a. Set TPG20:**

FORMAT 525/60 COMPONENT D1/YPrPb

Groups: BARS; SMPTE COLOR BARS 525 D1/YPrPb

- b.** Connect TPG20 SERIAL DIGITAL OUTPUT to the WFM601i.

- c. **Check** – WFM601i for correct video signal display. Repeat check for the second TPG20 SERIAL DIGITAL OUTPUT.

## **19. Check PAL 625/50 Component Digital Serial**

- a. **Set TPG20:**

FORMAT 625/50 COMPONENT D1/YPrPb

Groups: BARS; EBU COLOR BARS 625 D1/YPrPb

- b. Connect one of the TPG20 SERIAL DIGITAL OUTPUTs to the WFM601i.
- c. **Check** – WFM601i for correct video signal display. Repeat check for the second TPG20 SERIAL DIGITAL OUT.

## **20. Serial Signal Integrity**

- a. Connect TPG20 SERIAL DIGITAL OUTPUT to the WFM 601i, using a  $75\Omega$  cable. Terminate the loop through in  $75\Omega$ .
- b. **Check** – that the SERIAL DIGITAL OUTPUT amplitude is 800 mV  $\pm 10\%$ .
- c. Adjust the WFM 601i Variable Vertical Gain so that the eye pattern display is 10 divisions in height.
- d. **Check** – that the rise time and fall time are  $> 0.75$  ns and  $< 1.5$  ns (20% to 80%).
- e. **Check** – that any overshoot is less than 10%.

## **21. Input/Output Return Loss: >36 dB up to 4.5 MHz**

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***NOTE.** The Return Loss Check only needs to be done if repairs have been made on the Input circuitry.*

---

- a. **Set TPG20:**

FORMAT 525/60 COMPONENT YPrPb

Groups: FLAT FIELDS; BLACK 525 YPrPb

- b. Connect a precision  $50 \Omega$  cable to the spectrum analyzer RF Input, and another precision  $50 \Omega$  cable to the tracking generator output.
- c. Connect the tracking generator Output cable to the RF Input on the RF Bridge.

- d. Connect the RF Input cable to the RF Output on the RF Bridge.
- e. Select Demod/tracking generator on the spectrum analyzer and turn on the analyzer Tracking Generator.
- f. Set the spectrum analyzer tracking generator Fixed Level to 0.00 dBm.
- g. Set the spectrum analyzer Span/Div to 1 MHz and the resolution bandwidth to 3 kHz.
- h. Set the vertical scale to 10 dB.
- i. Set the Reference Level to the first major division from the top on the spectrum analyzer.
- j. Remove one of the cables from the RF Bridge.
- k. Set the spectrum analyzer cursor to 5 MHz and then set the marker to 5 MHz.
- l. Reconnect the cable removed in part j to the RF Bridge.
- m. Note the Reference Level Readout.
- n. Adjust the spectrum analyzer External Attenuation Amplitude by the amount noted in part m. Note: The Reference Level Readout should now be 0.00 dBm.
- o. Connect the precision high frequency  $75 \Omega$  terminator to the Device Under Test connector on the RF Bridge.
- p. **Check** – that the frequency response from 0 MHz to 4.5 MHz is  $\leq 40$  dBm.
- q. Return the frequency marker to 5 MHz if it was moved.
- r. Remove the precision high frequency terminator from the RF Bridge.
- s. Connect the Device Under Test connector on the RF Bridge to the Reference Input on the TPG20 through a male-to-male bnc adapter. Terminate the TPG20 Reference Input loop through with the precision high frequency terminator used in part o.
- t. **Check** – for a Reference Level Readout on the spectrum analyzer of  $\geq 36$  dBm up to 4.5 MHz.
- u. Move the RF Bridge to each of the 6 TPG20 Analog Outputs in turn, checking for a Reference Level Readout on the spectrum analyzer of  $\geq 36$  dBm.

## 22. Memory Tests

- a. If not already done, load the following patterns into the 9 TPG20 memory locations.

Make sure genlock is off.

1. 625/50 Composite	EBU Bars
2. 625/50 Composite	100% Bars
3. 625/50 Composite	Multiburst 5.8
4. 625/50 Composite	Line Sweep 6.5
5. 625/50 RGB	EBU Bars
6. 625/50 RGB	Line Sweep 6.5
7. 525/60 Composite	SMPTE Bars
8. 525/60 Composite	Line Sweep 6.5
9. 625/50 Composite	S&W Test #2 Style: Circular

Speed 5

Mode: Field

- b. Turn TPG20 off for at least one minute.
- c. Switch TPG20 power back on. The last active pattern before power down should be reloaded automatically.
- d. Connect TPG20 analog out B to video monitor.
- e. **Check** – the nine memories stored in step a by recalling them and viewing the signal on the monitor (set to the correct format).

## 23. RS232 Remote Port Tests

Connect PC serial port (e.g. COM1) to remote RS-232 port of unit (using 9-pin, straight-through, serial cable). Run terminal emulation software on the PC (e.g. Windows Terminal, Xtalk, Kermit, etc). Configure the PC port to 9600 baud, no parity, 8 bits data, 1 stop bit. Load and save different patterns in memories 1 to 9 on the TPG20. From the PC terminal, send the following data:

<ESC> n <CR>

where ESC is the escape key (1B hex), n is a number from 1 to 9. (ASCII) and <CR> is carriage return.

Ensure that the unit recalls the correct memory settings. If a memory is successfully recalled, then the unit echoes the following data, if not, no data is returned.

Mn OK<CR>

where n is the memory recalled.

#### **24. External PC load.**

Connect the PC data port to an IBM compatible PC using a 25 pin connector. Ensure that the unit is in its normal state (ie. not in any adjustment mode). From the PC, transfer a PAL/D2 full frame compressed pattern into the unit. The front panel display should indicate the status of the transfer. When complete, the loaded pattern should appear on the outputs and its title appears on the display. Check that no errors are received after the pattern has loaded (if so, file size does not match). Examine the picture loaded carefully and check that no pixels are missing and that all color areas appear correct. Check cross pulse area for missing or extra pixels.

---

***NOTE.** Using TPG20 test data disk, select drive – type the following command:  
TRANSFER GIRL-N.cps 1  
Check monitor for correct download of picture data.*

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#### **END OF PERFORMANCE CHECK PROCEDURE**

# Adjustment Procedure

Remove TPG20 top cover to gain access to adjustments and test links.

## 1. LCD Contrast Adjustment

- a. Connect the TPG20 to an ac power source, and turn the power on.
- b. **Adjust** – RV1 on the back of the front panel board to set the LCD contrast ratio. The readout should be easily visible under normal lighting conditions

## 2. Enter Factory Setup Mode

---

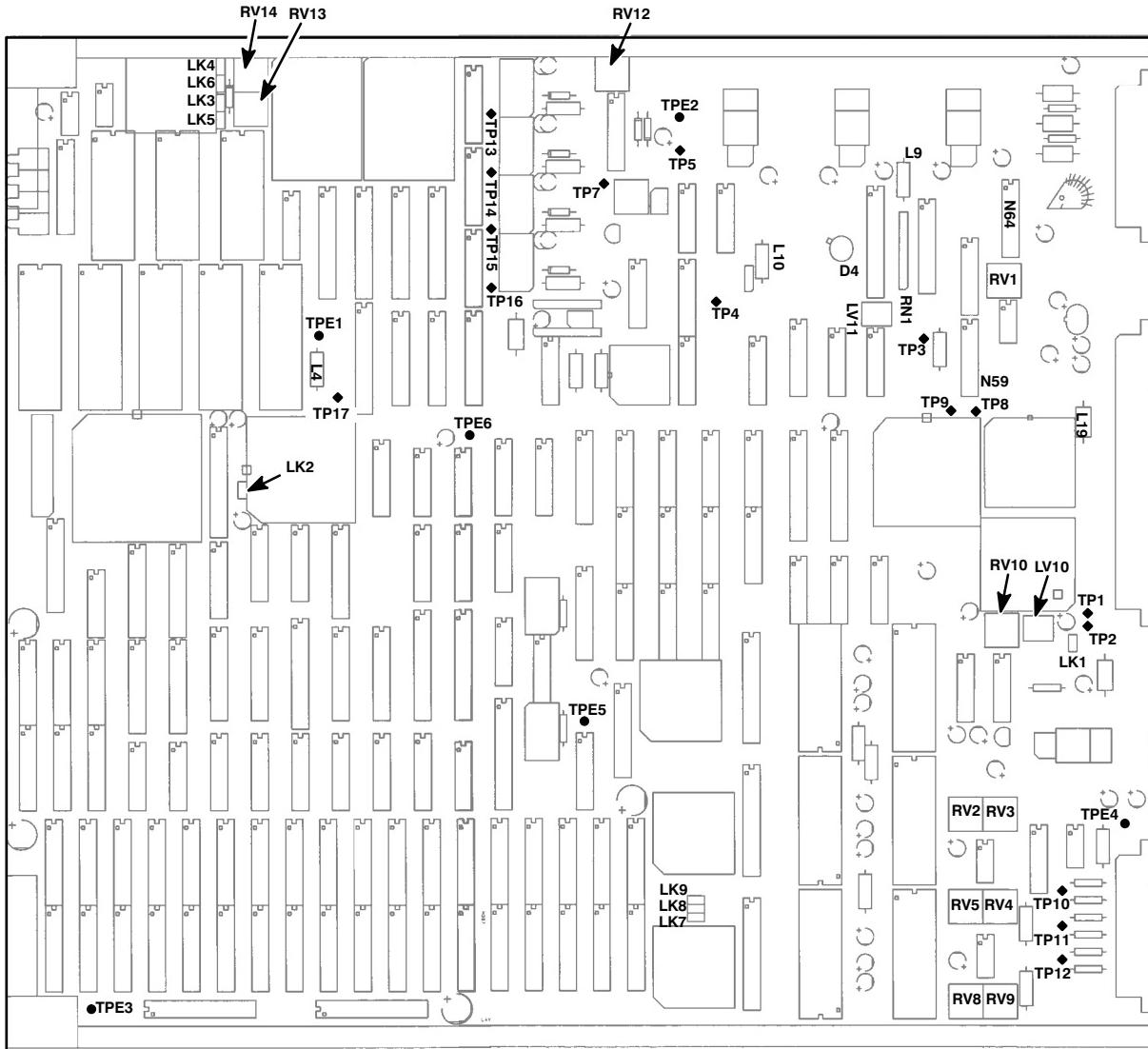
***NOTE.** for the following calibration steps the Factory Setup Mode must be enabled. This allows the instrument to store factory calibration constants in nonvolatile RAM.*

---

- a. Turn the TPG20 power off.
- b. Connect a clip lead from TP17 (see Figure 1–3) to ground.
- c. Hold down the SYSTEM button while turning the TPG20 power on. The TPG20 display should indicate “Factory setup mode” as long as the SYSTEM button is held down.

## 3. Serial Port Setup

- a. Press the SYSTEM button until the “Set:RS232 speed” menu appears.
- b. Rotate the knob until a baud rate of ”9600” appears on the bottom line of the display.
- c. Press the SELECT button to save the setting.



**Figure 1-3: Jumper (Link) and Adjustment locations on the TPG20 Main Board**

#### 4. Crystal Setup

**NOTE.** This step should not be necessary unless the original setup data has been corrupted for some reason.

- a. Enter the System setup menus and press the SYSTEM button until the setup for crystal 1 appears. Crystals 1 to 6 represent X3 to X8 respectively and by rotating the front panel knob, select the correct crystal ID that matches the crystal frequency. Table 1-1 shows the available crystal options that the unit can support.

**Table 1-1: Available TPG20 Crystal Options**

Type	Frequency	Usage Format
0	13.50 MHz	625/525 D1
1	17.73447 MHz	PAL & SECAM 4fsc
2	14.318180 MHz	NTSC 4fsc
3	14.328225 MHz	PAL N 4fsc
4	14.3024 MHz	PAL M 4fsc
5	18.56250 MHz	1125/60 & 1250/50
6	18.88116 MHz	1125/59.94 & 1050/59.94
7	N/A	User defined
8	N/A	User defined
9	N/A	User defined
10	N/A	Crystal not installed

- b.** Save the setting by pressing the SELECT button.
- c.** Repeat the setup for crystals 2 to 6. If no crystal is installed in the slot, then set it to type 10.

## 5. Output Level Calibration

### a. Set TPG20:

FORMAT 625/50 COMPONENT RGB

Groups: FLAT FIELDS; WHITE 100% 625 RGB

- b.** Connect the Video Calibrator, set to 1 volt chopped signal (VAC set to 999.9 mV), to both oscilloscope channels, using the dual input connector. Set the oscilloscope to 0.1 Volts/Div, invert one of the channels and sum them. Adjust the variable gain on one channel to null the signal.
- c.** Connect the video calibrator to channel two of the oscilloscope, and TPG20 Analog A Output (Y signal) to channel one. Retain all previous settings, triggering the oscilloscope on channel two.
- d.** Press the TPG20 SYSTEM button to select – Set:625 GBR.
- e.** **Adjust** – the output level of the TPG20 using the front panel knob, so that the bottom of sync of the top video trace coincides exactly with the top of video on the lower video trace.
- f.** Press TPG20 SELECT button to save this setting.

Repeat parts d through f of this step for the following formats using the Groups: FLAT FIELDS; WHITE 100% in each format.

FORMAT 625/50 COMPOSITE PAL/D2  
FORMAT 625/50 COMPONENT D1/YPrPb  
FORMAT 625/50 COMPONENT YPrPb  
FORMAT 625/50 COMPOSITE SECAM  
FORMAT 525/60 COMPOSITE NTSC D2 (use White 100 IRE)  
FORMAT 525/60 COMPONENT D1/YPrPb  
FORMAT 525/60 COMPONENT YPrPb  
FORMAT 525/60 COMPONENT RGB

## 6. DAC Offset Calibration

### a. Set TPG20:

FORMAT 625/50 COMPONENT RGB  
Groups: PULSES; PULSE & BAR 2T 625 RGB

b. Connect TPG20 Analog Output A to both channels of the oscilloscope, using the dual input connector. Set the oscilloscope to 0.1 Volts/Div, invert one of the channels and sum them. Adjust variable gain on one channel to null the signal.

c. Connect TPG20 Analog Output A to channel one of the oscilloscope. Connect TPG20 Analog Output B to channel two of the oscilloscope. Retain all previous settings, triggering the oscilloscope on channel two.

d. Press the TPG20 SYSTEM button to select – Set: DAC B Offset

e. **Adjust** – the TPG20 B Analog Output level, using the front panel knob to obtain the best cancellation of the pulse and bar signal on the oscilloscope.

f. Press the TPG20 SELECT button to save this setting.

g. Substitute TPG20 Analog C Output at channel two of the oscilloscope.

h. Press TPG20 SYSTEM button to select – Set: DAC C Offset

i. **Adjust** – the TPG20 C Analog Output level using the front panel knob to obtain the best cancellation of the pulse and bar signal on the oscilloscope.

- j. Press the TPG20 SELECT button to save this setting.

## 7. Load Factory Settings

- a. Press the TPG20 SYSTEM button to select Set:Factory Presets
- b. Press the TPG20 SELECt button to load factory settings.
- c. Switch TPG20 off.
- d. Remove the ground clip lead to TP17 that was attached in step 2.
- e. Switch TPG20 power back on without holding any buttons down.  
The factory setup parameters are now complete.

## 8. Frequency Calibration

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***NOTE.** After initial delivery or long storage allow a two-hour warm up to re-age the crystal. Thereafter, 30 minutes warm up is sufficient.*

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### NTSC 3.579545 MHz ± 2 Hz

#### a. Set TPG20:

FORMAT – 525/60 COMPOSITE NTSC/D2

Groups; BARS; SMPTE COLOR BARS 525 NTSC/D2

- b. Connect the DC5009 Frequency Counter to L10.
- c. Set the Frequency Counter to ratio B/A, Avg to  $10^7$ , and connect WWV to the A input.
- d. **Adjust** – RV13 for 3.579545 MHz ± 0.5 Hz.

### PAL 4.43361875 MHz ± 1 Hz

#### e. Set TPG20:

FORMAT – 625/50 COMPOSITE PAL/D2

Groups; BARS; EBU COLOR BARS 625 PAL/D2

- f. Leave the Frequency Counter connected to L10, and set as in part c of this step.
- g. **Adjust** – RV14 for 4.43361875 MHz ± 0.5 Hz.

## 9. Frequency Response Adjustment

### a. Set TPG20:

FORMAT 625/50 COMPONENT RGB

Groups: SWEEPS; LINE SWEEP 6.5 625 RGB

- b. Connect the TPG20 A Analog Output to the 1781R set to waveform monitor display.

- c. **Adjust** – RV2 for flat response  $\pm$  0.1 dB.

- d. Connect the TPG20 B Analog Output to the 1781R.

- e. **Adjust** – RV5 for flat response  $\pm$  0.1 dB.

- f. Connect the TPG20 C Analog Output to the 1781R.

- g. **Adjust** – RV8 for flat response  $\pm$  0.1 dB.

### h. Set TPG20:

FORMAT 525/60 COMPONENT RGB

Groups: SWEEPS; LINE SWEEP 5.5 525 RGB

- i. Connect TPG20 A Analog Output to the 1780R set to waveform monitor display.

- j. **Adjust** – RV3 for flat response  $\pm$  0.1 dB.

- k. Connect TPG20 B Analog Output to the 1780R.

- l. **Adjust** – RV4 for flat response  $\pm$  0.1 dB.

- m. Connect TPG20 C Analog Output to the 1780R.

- n. **Adjust** – RV9 for flat response  $\pm$  0.1 dB.

## 10. Serial Digital Output

### a. Set TPG20:

FORMAT 525/60 COMPONENT D1/YPrPb

Groups: BARS; SMPTE COLOR BARS 525 D1/YPrPb

- b. Install a shorting link (jumper) on LK1.

- c. Connect frequency counter to TP2.

- d. **Adjust** – RV10 for 27.0 MHz.

- e. Remove the shorting link (jumper) from LK2.

## 11. Genlock NTSC and PAL

- a. Using the Black/Sync signal of the TSG-170A – loop through the Reference Input on the TPG20 to CH 1 on the oscilloscope.
- b. Examine the signal on pin 7 of N59 (74HC4538) using a probe on CH 2 of the oscilloscope.
- c. Trigger the oscilloscope on the external reference (CH 1).
- d. **Adjust** – RV1 so that the burst gate at N59 pin 7 is centered about the burst of the input reference.

### e. Set TPG20:

FORMAT 525/60 COMPONENT D1/YPrPb

Groups: BARS; SMPTE COLOR BARS 525 D1/YPrPb

- f. Connect one of the TPG20 Analog B Outputs to CH 2 of the oscilloscope.
- g. **Adjust** – CV1 to obtain the minimum run through rate of the two signals on the oscilloscope.
- h. Hold down the TPG20 SYSTEM button and cycle the TPG20 power off and back on. The TPG20 display should indicate Factory setup mode.
- i. Deselect crystals X5 and X6 using the procedure above in step 4 (i.e. assign “No crystal” to X5 and X6).

### j. Set TPG20:

FORMAT 525/60 COMPOSITE NTSC/D2

Groups: BARS; SMPTE COLOR BARS 525 NTSC/D2

- k. **Adjust** – CV3 for minimum run through of the two signals as observed on the oscilloscope.
- l. Using the Black/Sync signal of the TSG271 – loop through the Reference Input of the TPG20 to CH 1 on the oscilloscope.

### m. Set TPG20:

FORMAT 625/50 COMPOSITE PAL/D2

Groups: BARS; EBU COLOR BARS 625 PAL/D2

- n. **Adjust** – CV2 for minimum run through of the two signals as observed on the oscilloscope.

**o. Set TPG20:**

FORMAT 625/50 COMPONENT RGB

Groups: FLAT FIELDS; WHITE 100% 625 RGB

**p. Adjust** – RV12 for minimum run through of the two signals as observed on the oscilloscope. (note: this adjustment has no effect if precision crystals are installed).

**q. Using** the TPG20 SYSTEM button, select "Factory Presets", then press the SELECT button. This will restore the crystal settings to their initial settings.

**r. Set TPG20:**

FORMAT 625/50 COMPOSITE PAL/D2

Groups: BARS; EBU COLOR BARS 625 PAL/D2

**s. Set** TPG20 Genlock to On. Select Lock on: SC–Phase Lock. Verify that genlock occurs within 20 seconds and the Genlock light is on (not blinking).

**t. Monitor** the signal at pin 11 of N141 with a probe attached to CH 2 of the oscilloscope.

**u. Adjust** – RV11 for a 1/2 line–rate square wave, centered about 0V DC.

## 12. Genlock SECAM

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**NOTE.** A SECAM signal source is required for this adjustment. This should be available locally if the SECAM format is actually being used. Otherwise, it should not be necessary to perform this adjustment

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**a. Using** a SECAM source signal, loop through the Reference Input on the TPG20 to CH 1 on the oscilloscope.

**b. Examine** the signal on pin 3 of N135 using a probe on CH 2 of the oscilloscope.

**c. Adjust** – LV11 to obtain a pulse every 2 lines of SECAM.

## END OF ADJUSTMENT PROCEDURE



## Section 2



## Section 2

# Replaceable Parts List

This section contains a list of the components that are replaceable for the TPG20. Use this list to identify and order replacement parts. This Replaceable Parts List combines electrical and mechanical parts instead of putting them into separate lists.

### Parts Ordering Information

Replacement parts are available through your local Tektronix, Inc., Field Office or representative. The parts list for the TPG20 is different than the normal TEKTRONIX parts lists. The nomenclature used is not the typical Tektronix nomenclature, and the processes used to order replacement parts is different, as well. Make sure to contact your local Tektronix representative when ordering parts.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number

2/16/94

assembly	Structure	FGAG 2020300A	TPG20 TEST PATTERN GENERATOR
Level	S&W PartId	S&W Description	
1	FGAG 2020300A	TPG20 TEST PATTERN GENERATOR	
2	SAAG 2022510A	TPG20 FINAL CHASSIS ASSEMBLY (WLV)	
3	SAAG 2021520A	TPG20 FRONT PANEL ASSEMBLY	
4	SAAG 2021590A	TPG20 FRONT PANEL HINGE ASSEMBLY	
4	SAAG TPGFP1Z	TPG FRONT PANEL PCB ASSY KUDOS	
3	SAAG 2021540A	TPG20 55W POWER SUPPLY ASSEMBLY (WLV) TEK P/N 118-9100-00	
3	SAAG 2021570A	TPG20 REAR PANEL ASSEMBLY	
4	SAAG 2021580A	TPG20 CONNECTOR PLATE ASSEMBLY	
4	SAAG TPGRPIA	TPG20 BACKPLANE PCB ASSY TEK P/N 118-9097-00	
2	SAAG TPGIB	TEST PATTERN GENERATOR PCB ASSY PART 1 OF 2	
3	SAAZ TPGIB2	TEST PATTERN GENERATOR PCB ASSY PART 2	
FGAG 2020300A	Mod A	TPG20 TEST PATTERN GENERATOR	
D M S	CctRef	S&W PartId	Qty      S&W Description
A A		RMMG 2020300A	2      SPACER HEX M/F (3Mx6mm thread with 3Mx4mm nut)
A A		RMGI M3x4P	2      SCREW M3x4 POZI PAN C/B TEK P/N 211-3010-00
A A		SAAG 2022510A	1      TPG20 FINAL CHASSIS ASSEMBLY (WLV)
A A		SAAG TPGIB	1      TEST PATTERN GENERATOR BOARD ASSY
SAAG 2022510A	Mod A		TPG20 FINAL CHASSIS ASSEMBLY (WLV)
D M S	CctRef	S&W PartId	Qty      S&W Description

## Replaceable Parts

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A A	RMMG 2021004A	1	IU FRAME 4 FIELD RACK MOUNTS PAINTED & SCREENED	
A A	RMH3 RCG-3	4	CARD GUIDES-RICHCO RCG-3	
A A	RMF9 06	1	FAN 40mm 12V DC SANYO 109P0412F602 TEK P/N 119-4800-00	
A A	RMG1 M4x2.5P	4	SCREW M4x2.5 POZI PAN	
A A	RMG6 WM4IS	4	M4 INTERNAL SHAKEPROOF WASHER	
A A	RMG5 NM4B	4	M4 FULL NUT CHEMICAL BLACK	
A A	RMKI 09	1	TERM HSG 2W POLARISED 6471-1-22-01-2025	
A A	RMK8 4809CL	2	CRIMP MOLEX 4809CL (LOOSE)	
A A	SAAG 2021540A	1	POWER SUPPLY ASSEMBLY 55W UPP55-344	
A A	RMH6 2020051A	1	MAINS ON/OFF LABEL	
A A	RMH6 2020011A	1	REMOVE SCREWS WARNING LABEL	
A A	SAAG 2021570A	1	TPG20 RAR PANEL ASSEMBLY	
A A	RMG0 M2.5x6P	5	SCREW M2.5x6 PAN POSI TEK P/N 211-3011-00	
A A	SAAG 2021520A	1	TPG20 FRONT PANEL ASSEMBLY	
A A	RMMG 2021140A	2	FRONT PANEL HINGE ASSEMBLY RETAINING PLATE	
A A	RMG1 M3x4CB	4	SCREW M3 x 4 BLACK CSK	
SAAG 2021520A	Mod A	TPG20	FRONT PANEL ASSEMBLY	
D M S	CctRef	S&W PartId	Qty	
A A	SAAG TPGFP1Z	1	TPG FRONT PANEL PCB ASSY	
A A	SAAG 2021590A	1	TPG20 FRONT PANEL HINGE ASSEMBLY	
A A	RMG1 M3x4P	5	SCREW M3x4 POZI PAN C/B TEK P/N 211-3010-00	
A A	RMMG 2020300A	5	SPACER HEX M/F (3Mx6mm thread with 3Mx4mm nut)	
A A	RMG6 WM3	5	WASHER M3 FLAT EBP	
A A	RMMG 2021170A	1	FRONT PANEL COVER PLATE (TPGFPI PCB)	
SAAG 2021590A	Mod A	TPG20	FRONT PANEL TO PCB CABLE TEK P/N 174-3305-00	
D M S	CctRef	S&W PartId	Qty	
A A	RMG1 M3x10P	4	SCREW M3x10 POZI PAN HD EBP	
A A	RMG5 NM3	4	NUT M3 EBP	
A A	RMG6 WM3IS	4	M3 INTERNAL SHAKEPROOF WASHER	
A A	RMG5 NM3NYLOC	4	NUT M3 NYLOC	
A A	RMMG 2021130A	2	HINGE ARM MOULDED	
A A	RMHG 2021120A	2	HINGE ARM BLOCX	
A A	RMMG 2020420A	1	TPG20 FRONT PANEL KUDOS	
A A	RMMG 2021450A	2	KUDOS FRONT PANEL LEVER	
A A	RMG0 25	4	SCREW M2.5X10 CSK	
A A	RMG6 WM2.5	4	WASHER M2.5 FLAT EB	
SAAG	TPGFP1Z	Mod ATPG	FRONT PANEL PCB ASSY KUDOS	
D M S	CctRef	S&W PartId	Qty	
A A	C1	RMB0 100p	1	CAPACITOR SM 100pF
A A	C2	RMD5 E47/16	1	CAP ELEC RADIAL 47uF 16V
A A	C3	RMD5 E47/16	1	CAP ELEC RADIAL 47uF 16V
A A	C4	RMB1 2n2	1	CAPACITOR SM 2n2 1206 X7R 10%T NBT
A A	C5	RMB1 2n2	1	CAPACITOR SM 2n2 1206 X7R 10%T NBT
A A	C6	RMB1 2n2	1	CAPACITOR SM 2n2 1206 X7R 10%T NBT
A A	C7	RMB1 100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
A A	CNI	RMK6 03	1	HEADER 20W LOW PROFILE
A A	CN2	RMK0 23	2	7 WAY SIL HEADER 2mm
A A	CNVI	RMY7 02	1	INVERTER TYPE 5S FOR LCD M16329DW
A A	D1	RMO0 589-014	1	LED GREEN 3mm LOW CURRENT RS 589-014
A A	D2	RMO0 589-014	1	LED GREEN 3mm LOW CURRENT RS 589-014
A A	D3	RMO0 1302R	1	LED HLMP 1302 HE RED
A A	LCD1	RMO5 LC2X16	1	DISPLAY LCD DOT MATRIX 2X16 CHAR'M16329DW Wires to main pcb BL/GND
A A		RMG8 M2.5x15 FF	4	SPACER M2.5 x 15mm F/F HEX
A A		RMG0 M2.5x6P	8	SCREW M2.5x6 PAN POSI TEK P/N 211-3011-00
A A	N1	RMI3 74HCT57	1	IC 74HCT574
A A	N2	RMI3 74HCT54	1	IC 74HCT541
A A	N3	RMI3 74HCT74	1	IC 74HCT74

A A	N4	RMI3 74HCT57	1	IC 74HCT574
A A	N5	RMI3 74HCT57	1	IC 74HCT574
A A	Q1	RMQ3 BSX20	1	TRANSISTOR BSX20
A A	R1	RMEI IK	1	RESISTOR SM 1K 1206.125W 2% NBT
A A	R2	RMEI IK	1	RESISTOR SM 1K 1206.125W 2% NBT
A A	R3	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R4	RMEI IK	1	RESISTOR SM 1K 1206.125W 2% NBT
A A	R5	RMEI 10K	1	RESISTOR SM 10K 1206.125W 2% NBT
A A	R6	RMEI 10K	1	RESISTOR SM 10K 1206.125W 2% NBT
A A	R7	RMEI 10K	1	RESISTOR SM 10K 1206.125W 2% NBT
A A	R8	RMEI 10K	1	RESISTOR SM 10K 1206.125W 2% NBT
A A	R9	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R10	RMEI IK5	1	RESISTOR SM 1K5 1206.125W 2% NBT
A A	R11	RMEI IK5	1	RESISTOR SM 1K5 1206.125W 2% NBT
A A	R12	RMEI IK5	1	RESISTOR SM 1K5 1206.125W 2% NBT
A A	R13	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R14	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R15	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R16	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R17	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R18	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R19	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R20	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R21	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	R22	RME0 470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
A A	RV1	RMV0 HIK	1	RES VAR HOR IK BOURNS 3386P-1-102
A A	RV2	RMO6 02	1	OPTICAL ENCODER 12B STEP ENAIJ-B28-L00128
A A	SW1	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1590 GREEN TEK P/N 150-1163-00
A A		RMSI OLP9	1	LIGHT PIPE FOR 9mm KEYCAP LICQN SERIES 39 SWITCH
A A		RMSI OLGL9	1	CAP 9mm LIGHT GREY LIT LICON SERIES 39 SWITCH
A A	SW2	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00
A A		RMSI OLP6	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH
A A		RMSI OLGL6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH
A A		RMG8 11	2	SPUER-LICON 39 SERIES SWITCH DWG 160044A
A A	SW3	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00
A A		RHSI OLP6	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH
A A		RMSI OLGL6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH
A A		RMG8 11	2	SPACER-LICON 39 SERIES SWITCH DWG 160044A
A A	SW4	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00
A A		RHSI OLP6	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH
A A		RMSI OLGL6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH
A A		RMG8 11	2	SPACER-LICON 39 SERIES SWITCH DWG 160044A
A A	SW5	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00
A A		RMSI OLP9	1	LIGHT PIPE FOR 9mm KEYCAP LICON SERIES 39 SWITCH
A A		RMSI OLGL9	1	CAP 9mm LIGHT GREY LIT LICON SERIES 39 SWITCH
A A		RMG8 11	2	SPACER-LICON 39 SERIES SWITCH DWG 160044A
A A	SW6	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00
A A		RMSI OLP6	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH
A A		RMSI OLGL6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH
A A		RMG8 11	2	SPACER-LICON 39 SERIES SWITCH DWG 160044A
A A	SW7	RMSI OBM	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39
A A		RMO0 1540G	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00

## Replaceable Parts

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A A	RMSI OLP6	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH	
A A	RMSI OLGL6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH	
A A	RMG8 11	2	SPACER-LICON 39 SERIES SWITCH DWG 160044A	
A A	SW8	1	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39	
A A	RMSI OBM	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00	
A A	RMOO 1540G	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH	
A A	RMSI OLP6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH	
A A	RMSI OLGL6	1	SPACER-LICON 39 SERIES SWITCH DWG 160044A	
A A	RMG8 11	2	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39	
A A	SW9	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00	
A A	RMOO 1540G	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH	
A A	RMSI OLP6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH	
A A	RMSI OLGL6	1	SPACER-LICON 39 SERIES SWITCH DWG 160044A	
A A	RMG8 11	2	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39	
A A	SW10	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00	
A A	RMOO 1540G	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH	
A A	RMSI OLP6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH	
A A	RMSI OLGL6	1	SPACER-LICON 39 SERIES SWITCH DWG 160044A	
A A	RMG8 11	2	SWITCH MOMEN'RY PB PCB+LED HOLDER LICON39	
A A	SW11	1	LED HLMP 1540 GREEN TEK P/N 150-1163-00	
A A	RMOO 1540G	1	LIGHT PIPE FOR 6mm KEYCAP LICON SERIES 39 SWITCH	
A A	RMSI OLP6	1	CAP 6mm LIGHT GREY LIT LICON SERIES 39 SWITCH	
A A	RMSI OLGL6	1	SPACER-LICON 33 SERIES SWITCH DWG 160044A	
A A	PCB	1	TPG FRONT PANEL PCB	
SAAG 2021540A	Mod A	TPG20	55W POWER SUPPLY ASSEMBLY (WLV) TEK P/N 118-9100-00	
D M S	CctRef	S&W PartId	Qty	S&W Description
A A	RMG9 2021100A1			POWER SUPPLY MOUNTING PLATE
A A	RMG5 NM3	9		NUT M3 EBP
A A	RMG6 WM3IS	1		M3 INTERNAL SHAKEPROOF WASHER
A A	RMG9 2020265A1			CVR45 POWER SUPPLY ASSEMBLY INSULATING PLATE
A A	RMG7 M3ST	4		SOLDER TAG M3 (6BA) TINNED
A A	RMG8 34	4		SPACER TAPPED METRIC M3 x 4.00mm R6371-02
A A	RMW6 BASE	3		CABLE TIE BASE 19mm x 19mm (RS 600-931)
A A	RMK9 09	3		SPADE TERMINAL CRIMP 6.3mm FEMALE
A A	RMK9 0.187	4		SPADE CRIMP TERM 0.181"(4.8mm) RED SHROUD
A A	RMK2 3069/5	1		TERM HOUSING 0.156" 5 WAY L/RP 3069 SER 09-91-0500AC I/P conn to PSU
A A	RMK2 3069/10	1		MOLEX HOUSING 10 WAY 3069/10 09911000
A A	RMH8 11	1		SW/PSU INSULATING WASHER
A A	RMK2 14	17		MOLEX CRIMP 1.56"
A A	RMK2 3069/8	1		8 WAY MOLEX HOUSING 0.156" 09-91-0800/3069.08
A A	RMF3 02	2		FUSE 20mm 5A ANTISURGE BUSSMAN VENDOR TEK P/N 159-0353-00
A A	RMW7 30	1		MAINS INLET RUBBER BOOT SCHAFFNER IB2
A A	RMS7 01	1		ROCKER SWITCH MORS 100B98NN
A A	RMK8 2A	1		MAINS FUSED FILTER INLET 2A RADIATRON 5200-2-43
A A	RYM5 UPP55-344	1		PSU UPP55-344 (DAREN)
A A	RMW9 13	0		WIRE 32/0.2 GREEN/YELLOW
A A	RMW1 02	0		WIRE PVC 16/0.2 RED
A A	RMW1 00	0		WIRE PVC 16/0.2 BLACK
A A	RMW1 01	0		WIRE PVC 16/0.2 BROWN
A A	RMW1 04	0		WIRE PVC 16/0.2 YELLOW
A A	RMW1 07	0		WIRE PVC 16/0.2 VIOLET
A A	RMW8 07	0		PVC MAINS CABLE 2183Y GREY 24/0.2mm 6A 100m REELS
SAAG 2021570A	Mod A	TPG20		REAR PANEL ASSEMBLY
D M S	CctRef	S&W PartId	Qty	S&W Description
A A	SAAG 2021580A	1		TPG20 CONNECTQR PLATE ASSEMBLY
A A	SAAG TPGRPIA	1		PCB ASSY TPG REAR PANEL
A A	RMG8 35	5		SPACER M2.5x10 HEX
A A	RMGI M3x4PB	5		SCREW M3 x 4 PAN HD BLACK TEK P/N 211-3009-00

Assembly BOM: SAAG 2021580A TPG20			CONNECTOR PLATE ASSEMBLY		
No	Qty	S&W PartId	S&W Description		
1	1	RMK0 07	CON/M 2W STR GOLD L/RP 6410-22-29-2021		
2	2	RMK4 S25WW	SOCKET WIREWRAP D PCB 25 WAY		
3	1	RMK4 S9	SKT D TYPE 9W PCB STRAIGHT		
4	6	RMK4	SCREWLOCK FEMALE SCREWLOCK ASSY D TYPE CONNECTORS SEE G8 14		
5	11	RMK8 10	INSULATED BNC		
6	1	RMMG 2020250A	REAR CONNECTOR PLATE DIGITAL PATTERN GENERATOR		
SAAG TPGRPIA Mod A TPG20			BACKPLANE PCB ASSY TEK P/N 118-9097-00		
D M S	CctRef	S&W PartId	Qty	S&W Description	
A A	C1	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	C2	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	C3	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	C4	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	C5	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	C6	RMD5 E47/16	1	CAP ELEC RADIAL 47uF 16V	
A A	C7	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	C8	RMD4 E47n	1	CAPACITOR POLYESTER BOX 47nF 63V PHILIPS	
A A	CN6	RMK0 15/P8L	1	CONN 8W PLUG LOCK 0.156 PITCH	
A A	CN8	RMK0 07	1	CON/M 2W STR GOLD LJRP 6410-22-29-2021	
A A	CNIA	RMK7 S48	1	SKT 41612 TYPE C 48W	
A A	CN2A	RMK7 S96	1	SKT 41612 TYPE C 96W	
A A	CN3A	RMK7 S48	1	SKT 41612 TYPE C 48W	
A A	D1	RMQ4 IN4003	1	DIODE IN4003	
A A	D2	RMQ4 IN4003	1	DIODE IN4003	
A A	L1	RMZ0 WIRELINK	0	WIRE LINK IN PLACE OF DEFINED PART	
A A	L2	RMZ0 WIRELINK	0	WIRE LINK IN PLACE OF DEFINED PART	
A A	L3	RMZ0 WIRELINK	0	WIRE LINK IN PLACE OF DEFINED PART	
A A	L4	RMZ0 WIRELINK	0	WIRE LINK IN PLACE OF DEFINED PART	
A A	L5	RMZ0 WIRELINK	0	WIRE LINK IN PLACE OF DEFINED PART	
A B	L6	RMZ0 WIRELINK	0	WIRE LINK IN PLACE OF DEFINED PART	
A A	R1	RMR9 IK	1	RESISTOR METAL FILM 1/4 WATT 1% IK	
A A	R2	RMR7 27	1	RES 27R 5% 2.5W	
A A	RMPG TPGRPIA		1	PCB TPG REAR PANEL	
SAAG TPGIB Mod E TEST PATTERN GENERATOR PCB ASSY PART 1 OF 2 – Revised 10-01-1994 TEK P/N 118-9095-00					
CctRef	S&W	PartId	Qty	S&W Description	
BT1	Y1	00	1	BATTERY NICAD RS591-477 TEK P/N 146-0108-00	
C1	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C2	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C3	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C4	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C5	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C6	D5	E22/16	1	CAP ELEC RADIAL 22uF 16V	
C7	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C8	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C9	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C10	D5	E22/16	1	CAP ELEC RADIAL 22uF 16V	
C11	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C12	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C13	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V	
C14	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)	
C15	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)	
C16	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C17	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)	
C18	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)	
C19	D5	E1/63	1	CAP ELEC RADIAL 1uF 63V	
C20	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C21	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00	
C22	B0	22p	1	CAPACITOR SM 22pF	

## Replaceable Parts

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C23	B0	22p	1	CAPACITOR SM 22pF
C24	B0	22p	1	CAPACITOR SM 22pF
C25	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C26	D5	E22/16	1	CAP ELEC RADIAL 22uF 16V
C27	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C28	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C29	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C30	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C31	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C32	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C33	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C34	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C35	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C36	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C37	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C38	D5	E4u7/35	1	CAP ELEC RADIAL 4u7F 35V
C39	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C40	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C41	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C42	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C43	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C44	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C45	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C46	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C47	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C48	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C49	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C50	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C51	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C52	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C53	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C54	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C55	B0	100p	1	CAPACITOR SM 100pF
C56	B0	22p	1	CAPACITOR SM 22pF
C57	B0	100p	1	CAPACITOR SM 100pF
C58	B0	22p	1	CAPACITOR SM 22pF
C59	B0	22p	1	CAPACITOR SM 22pF
C60	B0	100p	1	CAPACITOR SM 100pF
C61	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C62	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C63	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C64	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C65	D5	E10/16	1	CAP ELEC RADIAL 10uF 16V or 35V 0.1"
C66	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C67	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C68	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C69	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C70	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C71	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C72	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C73	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C74	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C75	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT
C76	B0	100p	1	CAPACITOR SM 100pF
C77	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C78	B0	100p	1	CAPACITOR SM 100pF
C79	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT
C80	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT

C81	B0	100p	1	CAPACITOR SM 100pF
C82	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C83	B0	15p	1	CAPACITOR SM 15pF
C84	B0	15p	1	CAPACITOR SM 15pF
C85	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C86	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C87	B0	15p	1	CAPACITOR SM 15pF
C88	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C89	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C90	B0	150p	1	CAPACITOR SM 150pF
C91	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT
C92	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C93	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C94	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C95	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C96	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C97	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C98	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C99	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C100	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C101	D5	E10/16	1	CAP ELEC RADIAL 10uF 16V or 35V 0.1"
C102	D5	E2u2/63	1	CAP ELEC RADIAL 2u2F 63V
C103	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C104	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C105	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C106	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C107	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C108	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C109	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C110	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C111	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C112	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C113	B0	220p	1	CAPACITOR SM 220pF 0805 COC 5% NBT
C114	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C115	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C116	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C117	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C118	D5	E4u7/35	1	CAP ELEC RADIAL 4u7F 35V
C119	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C120	B1	2n2	1	CAPACITOR SM 2n2 1206 X7R 10% T NBT
Cl21	D5	E4u7/16	1	CAP ELEC RADIAL 4u7F 35V
Cl22	D5	E4u7/16	1	CAP ELEC RADIAL 4u7F 35V
C123	D5	E4u7/16	1	CAP ELEC RADIAL 4u7F 35V
C124	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C125	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C126	D5	E10/16	1	CAP ELEC RADIAL 10uF 16V or 35V 0.1"
C127	B1	2n2	1	CAPACITOR SM 2n2 1206 X7R 10% T NBT
C128	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C129	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT
C130	B0	22p	1	CAPACITOR SM 22pF
C131	B0	22p	1	CAPACITOR SM 22pF
C132	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C133	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C134	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C135	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C136	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C137	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C138	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00

## Replaceable Parts

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C139	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C140	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C141	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C142	B0	68p	1	CAPACITOR SM 68pF
C143	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C144	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C145	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C146	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C147	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C148	B0	68p	1	CAPACITOR SM 68pF
C149	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C150	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C151	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C152	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C153	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C154	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C155	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C156	B0	22p	1	CAPACITOR SM 22pF
C157	B0	10p	1	CAPACITOR SM 10pF
C158	B0	22p	1	CAPACITOR SM 22pF
C159	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C160	B0	10p	1	CAPACITOR SM 10pF
C161	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C162	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C163	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C164	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C165	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C166	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C167	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C168	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C169	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C170	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C171	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C172	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C173	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C174	B1	ln	1	CAPACITOR SM lnF 0805 COG 5% NBT
C175	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT
C176	B0	220p	1	CAPACITOR SM 220pF 0805 COG 5% NBT
C177	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C178	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C179	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C180	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C181	C0	C6p8	1	CAP CER PLT 6p8 MULL 683 09688
C182	B0	22p	1	CAPACITOR SM 22pF
C183	B0	47p	1	CAPACITOR SM 47pF
C184	C1	1n	1	CAPACITOR SM 1nF 0805 COG 5% NBT
C185	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C186	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C187	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C188	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C189	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C190	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C191	D4	E470n	1	CAP POLYEST 470nF/63V PHILLIPS 37011474
C192	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C193	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C194	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C195	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C196	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00

C197	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C198	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
Cl99	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C200	Bl	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C201	D5	E10/16	1	CAP ELEC RADIAL 10uF 16V or 35V 0.1"
C202	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C203	C6	100n	1	CAP MONO 50V 100nF Z5U CZ20C 104Z
C204	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C205	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C206	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C207	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C208	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C209	D5	E47/16	1	CAP ELEC RADIAL 47uF 16V
C210	B0	47p	1	CAPACITOR SM 47pF
C211	B0	47p	1	CAPACITOR SM 47pF
C212	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C213	B0	22p	1	CAPACITOR SM 22pF
C214	B0	22p	1	CAPACITOR SM 22pF
C215	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C216	B0	47p	1	CAPACITOR SM 47pF
C217	B0	22p	1	CAPACITOR SM 22pF
C218	Bl	In	1	CAPACITOR SM lnF 0805 COG 5% NBT
C219	B0	22p	1	CAPACITOR SM 22pF
C220	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C221	B0	47p	1	CAPACITOR SM 47pF
C222	B0	47p	1	CAPACITOR SM 47pF
C223	Bl	In	1	CAPACITOR SM lnF 0805 COG 5% NBT
C224	B0	22p	1	CAPACITOR SM 22pF
C225	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C226	B0	47p	1	CAPACITOR SM 47pF
C227	B0	47p	1	CAPACITOR SM 47pF
C228	B0	100p	1	CAPACITOR SM 100pF
C229	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C230	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C231	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C232	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C233	Bl	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C234	Bl	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C235	Bl	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C236	Bl	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C237	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C238	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C239	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C240	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C241	Bl	In	1	CAPACITOR SM lnF 0805 COG 5b NBT
C242	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C243	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C244	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C245	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C246	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C247	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C248	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C249	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C250	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C251	Bl	In	1	CAPACITOR SM lnF 0805 COG 5% NBT
C252	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C253	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C254	Bl	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00

## Replaceable Parts

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C255	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C256	B1	10n	1	CAPACITOR SM 10nF 1206 X7R 10% NBT
C257	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C258	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C259	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C260	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C261	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C262	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C263	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C264	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C265	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C266	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C267	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C268	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C269	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C270	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C271	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C272	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C273	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C274	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C401	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C402	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C403	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C404	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C405	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C406	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C407	B1	100n	1	CAPACITOR SM 100nF 1206 X7R 10% NBT TEK P/N 283-5114-00
C408	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
C411	D5	E220/16	1	CAP ELEC RADIAL 220uF/16V (ECEAICU221)
CNII	K6	03	1	HEADER 20W LOW PROFILE
CNIA	K7	P48	1	PLUG 41612 TYPE C 48W R/A
CN2A	K7	P96	1	PLUG 41612 TYPE C 96W R/A
CN3A	K7	P48	1	PLUG 41612 TYPE C 48W R/A
CV1	D8	50p	1	CAP VAR 6-50pF (ORANGE) MIN CER WASHABLE
CV2	D8	50p	1	CAP VAR 6-50pF (ORANGE) MIN CER WASHABLE
CV3	D8	50p	1	CAP VAR 6-50pF (ORANGE) MIN CER WASHABLE
CV4	D8	50p	1	CAP VAR 6-50pF (ORANGE) MIN CER WASHABLE
D1	J1	LM385/1.2	1	IC DIODE E F NAT LM385BZ-1.2 VOLTAGE REF
D2	Q6	Z3V3	1	DIODE ZENER SM Z3V3 SOT 23
D3	Q6	BAV70	1	DIODE BAV70 SM SOT 23
D4	J1	ZN404	1	IC DIODE ZN404 VOLTAGE REF
D5	Q6	BAV70	1	DIODE BAV70 SM SOT 23
D6	Q6	BAV70	1	DIODE BAV70 SM SOT 23
D7	Q6	BAW56	1	DIODE SM BAW56
D8	Q6	BAW56	1	DIODE SM BAW56
D9	Q6	BAW56	1	DIODE SM BAW56
D10	Q6	BAV70	1	DIODE BAV70 SM SOT 23
D11	Q6	BAV70	1	DIODE BAV70 SM SOT 23
D12	Q0	BBII9	1	DIODE BBII9
D13	Q0	BBII9	1	DIODE BBII9
D14	Q0	BBII9	1	DIODE BBII9
D15	Q0	BBII9	1	DIODE BBII9
D16	Q6	BBII9	1	DIODE BBII9
D17	Q4	BBII9	1	DIODE BBII9
D18	Q6	BBII9	1	DIODE BBII9
D19	Q6	BAV70	1	DIODE BAV70 SM SOT 23
D20	Q0	5050G	1	LED HLMP 5050 GREEN
D21	Q0	5050G	1	LED HLMP 5050 GREEN

D22	Q0	5050G	1	LED HLMP 5050 GREEN
D23	Q0	5050G	1	LED HLMP 5050 GREEN
D21	Q6	BAT54C	1	SM DUAL DIODE SOT 23 BAT54C
D25	Q6	BAT54C	1	SM DUAL DIODE SOT 23 BAT54C
D26	Q0	BAT85	1	DIODE BAT 85
D27	Q0	BAT85	1	DIODE BAT 85
D28	Q6	Z6V2	1	DIODE ZENER SM Z6V2 SOT 23
D29	Q6	BAV70	1	DIODE BAV70 SM SOT 23
E1	G9	01	1	CARD EJECTOR & RIVET ETL 23607
E2	G9	01	1	CARD EJECTOR & RIVET ETL 23607
F1	F7	16	1	FILTER FARADAY FL390 TEK P/N 119-4805-00
F2	F7	16	1	FILTER FARADAY FL390 TEK P/N 119-4805-00
F3	F7	16	1	FILTER FARADAY FL390 TEK P/N 119-4805-00
HS18	H8	10	1	HEATSINK TO-220 21 DEG C/W STRAIGHT FINS
HS137	H8	10	1	HEATSINK TO-220 21 DEG C/W STRAIGHT FINS
HS138	H8	10	1	HEATSINK TO-220 21 DEG C/W STRAIGHT FINS
HS139	H8	10	1	HEATSINK TO-220 21 DEG C/W STRAIGHT FINS
K18	H8	09	1	INSULATING KIT FOR TO-220 (MICA)
K137	H8	09	1	INSULATING KIT FOR TO-220 (MICA)
K138	H8	09	1	INSULATING KIT FOR TO-220 (MICA)
K139	H8	09	1	INSULATING KIT FOR TO-220 (MICA)
L1	L1	4.7	1	INDUCTOR 4u7H SIGMA SC10
L2	L1	4.7	1	INDUCTOR 4u7H SIGMA SC10
L3	L1	4.7	1	INDUCTOR 4u7H SIGMA SC10
L4	L2	10	1	INDUCTOR 10uH SIGMA SC10
L5	L2	47	1	INDUCTOR 47uH SIGMA SC10
L6	L6	00	1	CHOKE HF MULL 4312-020-36640
L7	L6	00	1	CHOKE HF MULL 4312-020-36640
L8	L6	00	1	CHOKE HF MULL 4312-020-36640
L9	L2	10	1	INDUCTOR 10uH SIGMA SC10
L10	L2	22	1	INDUCTOR 22uH SIGMA SC10
L11	L0	0.56	1	INDUCTOR SIGMA SC10 0.56uH
L12	L1	2.7	1	INDUCTOR 2u7H SIGMA SC10
L13	L1	2.2	1	INDUCTOR 2u2H SIGMA SC10
L14	L1	3.3	1	INDUCTOR 3u3H SIGMA SC10
L15	L2	10	1	INDUCTOR 10uH SIGMA SC10
L16	L2	10	1	INDUCTOR 10uH SIGMA SC10
L18	L6	00	1	CHOKE HF MULL 4312-020-36640
L19	L6	00	1	CHOKE HF MULL 4312-020-36640
L21	L6	00	1	CHOKE HF MULL 4312-020-36640
L22	L3	100	1	INDUCTOR 100uH SIGMA SC10
L23	L3	100	1	INDUCTOR 100uH SIGMA SC10
L24	L3	100	1	INDUCTOR 100uH SIGMA SC10
LK1	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK2	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK3	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK4	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK5	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK6	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK7	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK8	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LK9	K0	09	1	HEADER 2W STR GOLD ALT 4030-22-10-2021
LV10	L7	T7BS0.27	1	INDUCTOR 0.27uH FIXED TOKO 283MS-R27K
LV10	L7	7KL	1	SCREENING CAN FOR INDUCTORS BONEX PART NO 420006
LV11	V7	47	1	INDUCTOR 47uH TOKO ll9ANA5871HM
N1	I7	74HCT5	1	IC 74HCT541
N2	I7	27C512	1	IC 27C512 64k x 8 EPROM CMOS 120nS (was 200nS)
N3	I6	622562	1	IC RAM 32kx8 80nS HIT HM62256LP-8 TEK P/N 156-3571-00

## Replaceable Parts

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N4	I6	622562	1	IC RAM 32kx8 80nS HIT HM62256LP-8 TEK P/N 156-3571-00
N5	I3	74HCT574	1	IC 74HCT574
N6	I3	74HCT04	1	IC 74HCT04
N7	I3	74HCT574	1	IC 74HCT574
N8	I3	74HCT574	1	IC 74HCT574
N9	I3	74HCT574	1	IC 74HCT574
N10	I3	74HCT574	1	IC 74HCT574
N11	I3	74HCT574	1	IC 74HCT574
N12	J2	TL084	1	IC TL084 OP AMP
N13	J0	TDC3310	1	IC TDC3310N6C DAC TEK P/N 156-4523-00
N14	J0	TDC3310	1	IC TDC3310N6C DAC TEK P/N 156-4523-00
N15	J0	TDC3310	1	IC TDC3310N6C DAC TEK P/N 156-4523-00
N16	J0	DAC8248	1	IC DAC8248
N17	J0	DAC8248	1	IC DAC8248
N18	J1	7805	1	IC 7805 5V VOLTAGE REG
N19	I7	22V10	1	IC GAL22V10-25PC 10 MACROCELL EPLD (LATTICE ONLY!)
N20	I3	74HC4052	1	IC 74HC4052
N21	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N22	I7	22V10	1	IC GAL22V10-25PC 10 MACROCELL EPLD (LATTICE ONLY!)
N23	I7	22V10	1	IC GAL22V10-25PC 10 MACROCELL EPLD (LATTICE ONLY!)
N24	I9	2242R2C	1	IC TMC2242R2C 12 BIT 30MHz DECIMATING FILTER
N25	U0	74F04	1	SM IC 74F04
N26	I9	2242R2C	1	IC TMC2242R2C 12 BIT 30MHz DECIMATING FILTER
N27	I9	2242R2C	1	IC TMC2242R2C 12 BIT 30MHz DECIMATING FILTER
N28	J2	LM3080	1	IC LM3080 (ALT. CA3080) TRANSCONDUCTANCE AMP
N29	J2	LM3080	1	IC LM3080 (ALT. CA3080) TRANSCONDUCTANCE AMP
N30	J2	LM3080	1	IC LM3080 (ALT. CA3080) TRANSCONDUCTANCE AMP
N31	J2	MC33174	1	IC MC33174P QUAD OP AMP SINGLE SUPPLY LOW POWER
N32	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N33	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N34	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N35	I5	621PLJ	1	IC VS621PLJ IO BIT TTL-ECL LINE DRIVER
N36	I7	A1020/68	1	IC A1020-1-PL68C 2000 GATE ARRAY J LEADED
N37	I9	SBX1601A	1	IC SBX/STV1601A SERIAL TRANSFER ENCODER 10 BIT TEK P/N 156-4132-01
N38	I7	27C040	1	IC 27C040 0.5M x 8 EPROM CMOS eg AM27C040-150DC
N39	I7	27C040	1	IC 27C040 0.5M x 8 EPROM CMOS eg AM27C040-150DC
N40	I7	A1020/84	1	IC A1020-1 PL84C 2000 GATE ARRAY J LEADED
N41	I7	27C040	1	IC 27C040 0.5M x 8 EPROM CMOS eg AM27C040-150DC
N42	I7	27C040	1	IC 27C040 0.5M x 8 EPROM CMOS eg AM27C040-150DC
N43	I7	22V10	1	IC GAL22V10-25PC 10 MACROCELL EP W (LATTICE ONLY!)
N44	I3	74HCT00	1	IC 74HCT00
N45	I8	80C552	1	IC PCB80C552-4 PHILIPS uP 16MHz LIKE 8051
N46	I7	27C040	1	IC 27C040 0.5M x 8 EPROM CMOS eg AM27C040-150DC
N47	I4	74F161	1	IC 74F161
N48	I4	74F161	1	IC 74F161
N49	I4	74F161	1	IC 74F161
N50	I4	74F161	1	IC 74F161
N51	I4	74F161	1	IC 74F161
N52	I4	74F161	1	IC 74F161
N53	I4	74F161	1	IC 74F161
N54	I4	74F161	1	IC 74F161
N55	I4	74F161	1	IC 74F161
N56	I6	8570	1	IC PCF8570P 256 BYTE RAM I^2C I/O
N57	I7	ATV750	1	IC ATMEL ATV750L-25DC EP W(IN 22V10 PACKAGE)
N58	I6	8570	1	IC PCFB570P 256 BYTE RAM I^2C I/O
N59	I3	74HC4538	1	IC 74HC4538
N60	J5	LM1881	1	IC LM1881 SYNC SEPARATOR
N61	U0	TDA4820T	1	IC SM TDA4820T SYNC SEPARATOR

N62	I3	74HC4538	1	IC 74HC453B
N63	J1	78L05	1	IC 78L05 5V 100mA REGULATOR
N64	I8	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N65	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N66	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N67	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N72	I4	74F157	1	IC 74F157
N73	I4	74F157	1	IC 74F157
N74	I4	74F157	1	IC 74F157
N75	I4	74F86	1	IC 74F86
N76	I4	74F86	1	IC 74F86
N77	I4	74F574	1	IC 74F574
N78	I4	74F574	1	IC 74F574
N79	I4	74F574	1	IC 74F574
N80	I4	74F86	1	IC 74F86
N81	I4	74F283	1	IC 74F283
N82	I4	74F283	1	IC 74F283
N83	I4	74F283	1	IC 74F283
N84	I4	74F283	1	IC 74F283
N85	I4	74F283	1	IC 74F283
N87	I3	74HCT04	1	IC 74HCT04
N89	I3	HCT154.3	1	IC 74HCT154 0.3"
N90	I3	74HCT21	1	IC 74HCT21
N91	U0	74F04	1	SM IC 74F04
N94	I3	HCT154.3	1	IC 74HCT154 0.3"
N95	I3	74HCT245	1	IC 74HCT245
N97	I7	ATV750	1	IC ATMEL ATV750L-25DC EPLD(IN 22V10 PACKAGE)
N98	I3	74HCT574	1	IC 74HCT574
N100	I3	74HCT04	1	IC 74HCT04
N101	I3	74HCT74	1	IC 74HCT74
N102	I4	74F574	1	IC 74F574
N124	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N125	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N126	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N127	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N128	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N129	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N130	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N131	I4	74F399	1	IC 74F399 QUAD 2 INPUT MUX
N133	I3	74HCT161	1	IC 74HCT161 SYNC' BINARY COUNTER + ASYNC CLEAR
N134	U0	EL2120	1	SM IC EL2120 TEK P/N 156-6415-01
N135	I3	74HCT00	1	IC 74HCT00
N136	J2	NE521	1	IC NE521 (ALT. 75107)
N137	J1	LM317T	1	IC LM317T VOLTAGE REGULATOR VARIABLE
N138	J1	LM337T	1	IC LM337T REGULATOR
N139	J1	7905	1	IC 7905 -5V REGULATOR
N140	U0	1496	1	SM IC LM1496M BALANCED MOD/DEMO
N141	J0	DG211	1	IC DG211CJ QUAD SPST SWITCH
N142	J2	TL084	1	IC TL084 OP AMP
N143	J0	DAC8248	1	IC DAC8248
N144	U0	1496	1	SM IC LM1496M BALANCED MOD/DEMO
N145	U0	1496	1	SM IC LM1496M BALANCED MOD/DEMO
N146	J2	TL084	1	IC TL084 OP AMP
N147	I3	74HCT74	1	IC 74HCT74
N148	I3	74HCT74	1	IC 74HCT74
N149	J2	TL084	1	IC TL084 OP AMP
N151	J0	CX23065	1	IC CX23065A DIGITAL PHASE COMPARATOR 14MHZ
N152	J0	CX23065	1	IC CX23065A DIGITAL PHASE COMPARATOR 14MHZ

## Replaceable Parts

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N153	I5	10115	1	IC 10115
N154	I3	74HC4052	1	IC 74HC4052
N155	I5	10125	1	IC MC10125L
N156	I4	74F00	1	IC 74F00
N157	I4	74F74	1	IC 74F74 (NOT TI)
N158	I7	ATV750	1	IC ATMEL ATV750L-25DC EPLD (IN 22V10 PACKAGE)
N159	I7	74F04	1	SM IC 74F04
N160	I7	ATV750	1	IC ATMEL ATV750L-25DC EPLD (IN 22V10 PACKAGE)
N161	I7	ATV750	1	IC ATMEL ATV750L-25DC EPLD (IN 22V10 PACKAGE)
N162	U0	74F04	1	SM IC 74F04
N163	I7	ATV750	1	IC ATMEL ATV750L-25DC EPLD(IN 22V10 PACKAGE)
N164	I9	MC88915	1	IC MC88915 FN55 CLOCK DOUBLER
N168	I3	74HCT574	1	IC 74HCT574
N169	I3	74HCT574	1	IC 74HCT574
N170	I7	ATV750	1	IC ATMEL ATV750L-25DC EPLD(IN 22V10 PACKAGE)
N171	I3	74HCT74	1	IC 74HCT74
N172	I3	74HCT00	1	IC 74HCT00
N173	I3	74HCT74	1	IC 74HCT74
N175	I3	74HCT574	1	IC 74HCT574
N178	I3	74HCT574	1	IC 74HCT574
N179	I3	74HCT574	1	IC 74HCT574
N183	J2	TL084	1	IC TL084 OP AMP
N347	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N348	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N349	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N350	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N351	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N352	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N353	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N354	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N355	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N356	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N357	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N358	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N363	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N364	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N365	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N366	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N367	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N368	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N369	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N370	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N371	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N392	I3	HCT154.3	1	IC 74ECT154 0.3"
N396	I3	HCT154.3	1	IC 74HCT154 0.3"
N403	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N404	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N405	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N406	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N407	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N408	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N409	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N410	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N411	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N412	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N413	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N414	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N415	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00

N416	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N417	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N418	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N419	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N420	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N421	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N422	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
N423	I6	53051P-34	1	IC HM53051P-34 FIELD DELAY TEK P/N 156-6914-00
PCB	PG	TPGIC	1	TPG TEST PATTERN GENERATOR PCB
PCB	PG	TPGIB	1	TEST PATTERN GENERATOR PCB
Q1	Q2	BCW30	1	TRANSISTOR SM BCW 30 (PNP) SOT23/BCW70
Q2	Q2	BCW30	1	TRANSISTOR SM BCW 30 (PNP) SOT23/BCW70
Q3	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q4	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q5	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q6	Q2	BCW30	1	TRANSISTOR SM BCW 30 (PNP) SOT23/BCW70
Q7	Q2	BCW30	1	TRANSISTOR SM BCW 30 (PNP) SOT23/BCW70
Q8	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q9	Q2	BFR93	1	TRANSISTOR BFR93 (NPN) SM SOT23
Q10	Q2	BFR93	1	TRANSISTOR BFR93 (NPN) SM SOT23
Q11	Q2	BCW32	1	TRANSISTOR SM BCW32 (NPN)
Q12	Q3	U404	1	TRANSISTOR U404
Q13	Q2	BCW32	1	TRANSISTOR SM BCW32 (NPN)
Q14	Q2	BCW32	1	TRANSISTOR SM BCW32 (NPN)
Q15	Q2	BCW30	1	TRANSISTOR SM BCW 30 (PNP) SOT23/BCW70
Q16	Q2	BCW32	1	TRANSISTOR SM BCW32 (NPN)
Q17	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q18	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q19	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q20	Q2	SST309	1	TRANSISTOR SM SST 309 SOT 23 (FET)SLCNIX
Q21	Q2	BCW30	1	TRANSISTOR SM BCW 30 (PNP) SOT23/BCW70
Q22	Q2	BCW32	1	TRANSISTOR SM BCW32 (NPN)
Q23	Q2	BCW32	1	TRANSISTOR SM BCW32 (NPN)
R1	E0	220R	1	RESISTOR SM 120G .125W 2TOL NBT 220R
R2	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R3	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R4	R9	4R7	1	RESISTOR PR01 IW 4R7
R5	E1	6K8	1	RESISTOR SM 6K8 1206 .125W 2% NBT
R6	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R7	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470
R8	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R9	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R10	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R11	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R12	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R13	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R14	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R15	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R16	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R17	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R18	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R19	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R20	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R21	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R22	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R23	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R24	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R25	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R

## Replaceable Parts

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R26	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R27	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R28	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R29	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R30	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R31	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R32	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R33	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R34	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R35	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R36	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R37	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R38	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R39	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R40	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R41	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R42	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R43	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R44	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R45	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R46	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R47	E0	75K	1	RESISTOR SM 1206 .125W 2TOL NBT 75R
R48	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R49	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R50	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R51	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R52	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R53	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R54	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R55	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R56	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R57	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R58	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R59	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R60	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R61	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R62	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R63	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22R
R64	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R65	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R66	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R67	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R68	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R69	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R70	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R71	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R72	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R73	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R74	E4	22K	1	RESISTOR SM 22R 1206 .125W 2% NBT
R75	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R76	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R77	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R78	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R79	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R80	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R81	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R82	E1	IK	1	RESISTOR SM IR 1206 .125W 2% NBT
R83	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R

R84	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R85	E1	1K5	1	RESISTOR SM IK5 1206 .125W 2% NBT
R86	R8	75R0	1	RES M/FLM 0.25W 0.5% 75R0
R87	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R88	R8	75R0	1	RES M/FLM 0.25W 0.5% 75R0
R89	R8	75R0	1	RES M/FLM 0.25W 0.5% 75R0
R90	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R91	R8	75R0	1	RES MIFLM 0.25W 0.5% 75R0
R92	E1	IK5	1	RESISTOR SM IK5 1206 .125W 2% NBT
R93	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R94	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R95	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22
R96	R8	75R0	1	RES M/FLM 0.25W 0.5% 75R0
R97	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R98	R8	75R0	1	RES MIFLM 0.25W 0.5% 75R0
R99	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R100	E1	IK5	1	RESISTOR SM 1K5 1206 .125W 2% NBT
R101	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R102	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22R
R103	E0	10R	1	RESISTOR SM 1206 .125W 2TOL NBT 10R
R104	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R105	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R106	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R107	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R108	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R109	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R110	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R111	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R112	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R113	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R114	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R115	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R116	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R117	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R118	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R119	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R120	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R121	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R122	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R123	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22R
R124	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22R
R125	E0	75R	1	RESISTOR SM 1206 .125W 2TOL NBT 75R
R126	E0	75R	1	RESISTOR SM 1206 .125W 2TOL NBT 75R
R127	E0	75R	1	RESISTOR SM 1206 .125W 2TOL NBT 75R
R128	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R129	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R130	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R131	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R132	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R133	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R134	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R135	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R136	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R137	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R138	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R139	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R140	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R141	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R

## Replaceable Parts

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R142	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R143	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R144	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R145	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R146	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R147	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R148	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R149	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R150	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R151	E1	IK5	1	RESISTOR SM IK5 1206 .125W 2% NBT
R152	Es	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R153	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R154	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R155	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R156	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R157	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R158	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R159	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R160	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R161	E1	15K	1	RESISTOR SM 15K 1206 .125W 2% NBT
R162	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R163	E1	1K	1	RESISTOR SM 1K 1206 .125W 2% NBT
R164	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R165	E1	15K	1	RESISTOR SM 15K 1206 .125W 2% NBT
R166	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R167	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R168	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R169	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R170	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R171	E1	3K3	1	RESISTOR SM 3K3 1206 .125W 2% NBT
R172	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R173	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R174	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R175	E4	33K	1	RESISTOR SM 33K 1206 .125W 2% NBT
R176	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R177	R5	100K	1	RES M/FLM 100K .4W 5%
R178	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22R
R179	E0	22R	1	RESISTOR SM 1206 .125W 2TOL NBT 22R
R180	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R181	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R182	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R183	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R184	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R185	E4	33K	1	RESISTOR SM 33K 1206 .125W 2% NBT
R186	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R187	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R188	E4	33K	1	RESISTOR SM 33K 1206 .125W 2% NBT
R189	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R190	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R191	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R192	R5	100K	1	RES M/FLM 100K .4W 5%
R193	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R194	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R195	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R196	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R197	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R198	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R199	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R

R200	E0	150R	1	RESISTOR SM 1206 .125W 2TOL NBT 150R
R201	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R202	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R203	E0	47R	1	RESISTOR SM 1206 .125W 2TOL NBT 47R
R204	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R205	E1	1K	1	RESISTOR SM 1K 1206 .125W 2% NBT
R206	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R208	E1	1K5	1	RESISTOR SM 1K5 1206 .125W 2% NBT
R209	E1	1K5	1	RESISTOR SM 1K5 1206 .125W 2% NBT
R210	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R211	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R214	E1	1K5	1	RESISTOR SM 1K5 1206 .125W 2% NBT
R215	E1	1K5	1	RESISTOR SM 1K5 1206 .125W 2% NBT
R216	E1	6K8	1	RESISTOR SM 6K8 1206 .125W 2% NBT
R217	E1	1K	1	RESISTOR SM 1K 1206 .125W 2% NBT
R218	E1	6K8	1	RESISTOR SM 6K8 1206 .125W 2% NBT
R219	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R220	E1	3K3	1	RESISTOR SM 3K3 1206 .125W 2% NBT
R221	E1	1K	1	RESISTOR SM 1K 1206 .125W 2% NBT
R222	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R223	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R224	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R225	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R226	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R227	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R228	E4	1M	1	RESISTOR SM 1M 1206 .125W 2% NBT
R229	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R230	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R231	E1	3K3	1	RESISTOR SM 3K3 1206 .125W 2% NBT
R232	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R233	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R234	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R235	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R236	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R237	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R238	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R239	E0	680R	1	RESISTOR SM 1206 .125W 2TOL NBT 680R
R240	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R241	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R242	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R243	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R244	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R245	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R246	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R247	E1	1K	1	RESISTOR SM 1K 1206 .125W 2% NBT
R248	E1	6K8	1	RESISTOR SM 6K8 1206 .125W 2% NBT
R249	E1	3K3	1	RESISTOR SM 3K3 1206 .125W 2% NBT
R250	E4	33K	1	RESISTOR SM 33K 1206 .125W 2% NBT
R251	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R252	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R253	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R255	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R256	E1	3K3	1	RESISTOR SM 3K3 1206 .125W 2% NBT
R257	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R258	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R259	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R260	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R261	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT

## Replaceable Parts

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R262	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R263	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R264	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R265	E0	330R	1	RESISTOR SM 1206 .125W 2TOL NBT 330R
R266	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R267	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R268	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R269	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R270	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R271	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R272	E4	22K	1	RESISTOR SM 22K 1206 .125W 2% NBT
R273	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R274	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R276	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R277	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R278	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R279	E1	2K2	1	RESISTOR SM 2K2 1206 .125W 2% NBT
R280	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R282	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R283	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R284	E0	75R	1	RESISTOR SM 1206 .125W 2TOL NBT 75R
R285	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R286	E0	10R	1	RESISTOR SM 1206 .125W 2TOL NBT 10R
R287	E4	1M	1	RESISTOR SM IM 1206 .125W 2% NBT
R288	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R289	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R290	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R291	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R292	E0	470	1	RESISTOR SM 1206 .125W 2TOL NBT 470K
R293	E4	1M	1	RESISTOR SM 1206 .125W 2TOL NBT
R294	E4	47K	1	RESISTOR SM 1206 .125W 2TOL NBT
R295	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT
R296	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R297	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R298	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R299	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R300	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R301	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R302	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R303	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R304	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R305	E4	IM	1	RESISTOR SM IM 1206 .125W 2% NBT
R306	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT
R307	E0	220R	1	RESISTOR SM 1206 .125W 2TOL NBT 220R
R308	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R309	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R310	E1	100K	1	RESISTOR SM 100K 1206 .125W 2% NBT
R311	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R312	E0	10R	1	RESISTOR SM 1206 .125W 2TOL NBT 10R
R313	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R314	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R315	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R316	E1	4K7	1	RESISTOR SM 4K7 1206 .125W 2% NBT
R317	E1	IK	1	RESISTOR SM IK 1206 .125W 2% NBT
R318	E0	10R	1	RESISTOR SM 1206 .125W 2TOL NBT 10R
R323	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R324	E1	10K	1	RESISTOR SM 10K 1206 .125W 2% NBT
R325	E4	47K	1	RESISTOR SM 47K 1206 .125W 2% NBT

R326	E1	1K	1	RESISTOR SM IK 1206 .125W 2% NBT
R327	E1	1K	1	RESISTOR SM IK 1206 .125W 2% NBT
R328	E4	1M	1	RESISTOR SM IM 1206 .125W 2% NBT
R329	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R330	E0	75R	1	RESISTOR SM 1206 .125W 2TOL NBT 75R
R331	E0	100R	1	RESISTOR SM 1206 .125W 2TOL NBT 100R
R332	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R333	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R334	E4	33K	1	RESISTOR SM 33K 1206 .125W 2% NBT
R401	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R402	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R403	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R404	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R405	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R406	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R407	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R408	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R409	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R410	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R411	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R412	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R413	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R414	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R415	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R416	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R417	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R418	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R419	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R420	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R421	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R422	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R423	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R424	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R425	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R426	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R427	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R428	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R429	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R430	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R431	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
R432	E0	470R	1	RESISTOR SM 1206 .125W 2TOL NBT 470R
RNI	N0	06	1	RES NETWORK Bx4K7 A.B.770-91
RV1	V0	H10K	1	RES VAR HOR 10K BOURNS 3386P-1-103
RV2	V0	H1K	1	RES VAR HOR 1K BOURNS 33B6P-1-102
RV3	V0	H2K	1	RES VAR HOR 2K BOURNS 3386P-1-202
RV4	V0	H2K	1	RES VAR HOR 2K BOURNS 3386P-1-202
RV5	V0	H1K	1	RES VAR HOR 1K BOURNS 3386P-1-102
RV8	V0	H1K	1	RES VAR HOR 1K BOURNS 3386P-1-102
RV9	V0	H2K	1	RES VAR HOR 2K BOURNS 3386P-1-202
RV10	V0	H10K	1	RES VAR HOR 10K BOURNS 3386P-1-103
RV11	V0	H50R	1	RES VAR HOR 50K BOURNS 3386P-1-503
RV12	V0	H10K	1	RES VAR HOR 10K BOURNS 3386P-1-103
RV13	V0	H20K	1	RES YAR HOR 20K BOURNS 3386P-1-203
RV14	V0	H20K	1	RES VAR HOR 20K BOURNS 3386P-1-203
SF1	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SF2	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SF3	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SN2	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")

## Replaceable Parts

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SN3	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SN4	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SN13	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SN14	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SN15	K8	28	1	SOCKET DIL LOW PROFILE 28 WAY (0.6")
SN16	K8	24/.3	1	IC SKT 24W .3 PITCH
SN17	K8	24/.3	1	IC SKT 24W .3 PITCH
SN19	K8	24/.3	1	IC SKT 24W .3 PITCH
SN22	K8	24/.3	1	IC SRT 24W .3 PITCH
SN23	K8	24/.3	1	IC SKT 24W .3 PITCH
SN24	K8	44PLCC	1	IC SKT 44W PLCC (USE AMP OR AUGAT ONLY)
SN26	K8	44PLCC	1	IC SKT 44W PLCC (USE AMP OR AUGAT ONLY)
SN27	K8	44PLCC	1	IC SKT 44W PLCC (USE AMP OR AUGAT ONLY)
SN35	K8	52PLCC	1	IC SKT 52W PLCC (USE AMP OR AUGAT ONLY)
SN36	K8	68PLCC	1	IC SKT 68W PLCC (USE AMP OR AUGAT ONLY)
SN37	K8	37PGA	1	IC SKT 37 PGA (10x10 MATRIX +ID pin)
SN38	K8	32.6	1	SKT IC 32W 0.6" PITCH
SN39	K8	32.6	1	SKT IC 32W 0.6" PITCH
SN40	K8	84PLCC	1	IC SKT 84W PLCC (USE AMP OR AUGAT ONLY)
SN41	K8	32.6	1	SKT IC 32W 0.6" PITCH
SN42	K8	32.6	1	SKT IC 32W 0.6" PITCH
SN43	K8	24/.3	1	IC SKT 24W .3 PITCH
SN45	K8	68PLCC	1	IC SKT 68W PLCC (USE AMP OR AUGAT ONLY)
SN46	K8	32.6	1	SKT IC 32W 0.6" PITCH
SN57	K8	24/.3	1	IC SKT 24W .3 PITCH
SN97	K8	24/.3	1	IC SKT 24W .3 PITCH
SN143	K8	24/.3	1	IC SKT 24W .3 PITCH
SN158	K8	24/.3	1	IC SKT 24W .3 PITCH
SN160	K8	24/.3	1	IC SKT 24W .3 PITCH
SN161	K8	24/.3	1	IC SKT 24W .3 PITCH
SN163	K8	24/.3	1	IC SKT 24W .3 PITCH
SN164	K8	28PLCC	1	IC SKT 28W PLCC (USE AMP OR AUGAT ONLY)
PART2	ZZ	TPGIB2	1	TEST PATTERN GENERATOR PART2 OF PARTS LIST
SN170	K8	24/.3	1	IC SKT 24W .3 PITCH
TP1	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP2	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP3	RMX9	00	1	TEST POINT SMALL VERO 20-2137D
TP4	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP5	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP6	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP7	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP8	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP9	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP10	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP11	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP12	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP13	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP14	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP15	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP16	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TP17	RMK9	00	1	TEST POINT SMALL VERO 20-2137D
TPE1	RMK9	01	1	TEST POINT LARGE VEROSPEED 20-2136J
TPE2	RMK9	01	1	TEST POINT LARGE VEROSPEED 20-2136J
TPE3	RMK9	01	1	TEST POINT LARGE VEROSPEED 20-2136J
TPE4	RMK9	01	1	TEST POINT LARGE VEROSPEED 20-2136J
TPE5	RMK9	01	1	TEST POINT LARGE VEROSPEED 20-2136J
TPE6	RMK9	01	1	TEST POINT LARGE VEROSPEED 20-2136J
X1	RMX7	01	1	XTAL 16.0 MHz 30pF HC43/U

X2	RMX3	04	1	XTAL 3.686400 MHz 30pF-HC18/U	
X3	RMX7	11	1	XTAL 13.5MHz 15ppm HC42	
X4	RMX7	05	1	XTAL 17.73447 MHz 30pF HC43/U	
X5	RMX7	04	1	XTAL 14.31818 MHz 30pF HC43/U	
X7	RMX7	16	1	CRYSTAL TCXO 14.318180 MHz QC6313/IA-IA lppm	
X8	RMX7	17	1	CRYSTAL TCXO 17.734475 MHz O-C6313/IA-IA lppm	CHANGED FROM 0.2PPM SG

## COMPLETE SOFTWARE PACKAGE

CARD	LQC'N	DEVICE	PROG.	PROG.	PART
TPG1Z	N19	GAL22V10-25LP	TPG19A1	909B	I7 22V10
TPG1B	N22	GAL22V10-25LP	TPG22A1	909B	I7 22V10
	N23	GAL22V10-25LP	TPG23A1	909B	I7 22V10
	N43	GAL22V10-25LP	TPG43A1	51C2	I7 22V10
	N57	ATV750L-25DC	TPG57A3	2CEF	I7 ATV750
	N97	ATV750L-25DC	TPG97A2	3A05	I7 ATV750
	N160	ATV750L-25DC	TPG160A6	38A5	I7 ATV750
	N161	ATV750L-25DC	TPG161A3	E1OE	I7 ATV750
	N163	ATV750L-25DC	TPG163A1	P660	I7 ATV750
	N170	ATV750L-25DC	TPG170A7	CFD	I7 ATV750
	*N158	ATV750-25	TPG158A1	262A	I7 AIV750-25

\*MUST BE ATV750 NOT AT~750L

N2	27C512-120	TPG02A81	A598	I7 27C512
N36	A1020A-1 68P	TPG36A2	OPIFMT2	I7 A1020/68

## PROM &amp; ACTEL LIST FOR TPG20-M VARIATIONS

CARD	LOC'N	DEVICE	PROG.	PROG/	PART
TPG1Z	N38	27C4001-150	TPG38M8	P40	I7 27C040
TPG1B	N39	27C4001-150	TPG39M8	3CC7	I7 27C040
	N41	27C4001-150	TPG41M8	AEE6	I7 27C040
	N42	27C4001-150	TPG42M8	ABC5	I7 27C040
	N46	27C4001-150	TPG46M8	5573	I7 27C040
	N40	A1020A-1 84P	TPG40M1	DMAKM	I7 A1020/84

## Assembly No. 300-254 - Power Supply

Qty	LOC'N	Part No.	Description
1		060-334	PCB UPP55
1		100-218	H/S ASSY UPP55-342
1		100-219	H/S ASSY MJE18006/DBLT150
1		202-108	W/C P408
1		200-130	W/C 130
1		201-040	W/C 1042 EGA
3		201-023	W/C 1025
2		103-000	OR .25W RES CF
1	R8	103-6R8	6R8 .25W RES CF
1	R19	103-10R	10R .25W RES CF
3	R3, R7, R10	103-151	150R .25W RES CF
1	R20	103-301	300R .25W RES CF
1	R18	103-331	330R .25W RES CF
1	R11	103-102	1K .25W RES CF
1	R6	103-222	2K2 .25W RES CF
1	R8	103-682	6K8 .25W RES CF
2	R13, R14	013-006	390R .5W RES CF
1	R9	013-007	470R .5W RES CF
1	R5	010-502	1R .5W RES MF
1	R15	016-050	100R POT PRE PNZ11
1	R2	017-002	15R THERMISTOR VA1100
1	R16	017-003	33R THERMISTOR
1	R4	017-004	4K7 THERMISTOR VA1109
1	R12	014-008	150K 1W RES FP1
1	R1	015-015	10K 5W RES PLUGGABLE KP294-0

## **Replaceable Parts**

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5	C9, C14, C17, C20	022-008	.22UF 100V CAP RAD POLYE 10mm
1	C16	022-016	220pF 1KV CAP HV DISC CERAM
3	C3, C4, C5	022-021	4700pF 250V CAP CLASS Y TYP WY
1	C8	022-002	.01uF 1KV CAP CERAMIC
2	C1, C2	022-022	.1uF 250V CAP CLASS X
1		021-001	1uF 63V CAP ELEC RAD 105C
1	C10	021-002	10uF 25V CAP ELEC RAD 105C
3	C13, C16, C19	021-007	1000uF 16V CAP ELEC RAD 105C
2	C12, C18	021-014	2200uF 16V CAP ELEC RAC 105C
1	C15	021-027	4700uF 10V CAP ELEC RAD 105C
2	C6, C7	020-041	100uF 400V CAP ELEC RAD 85C SI
1	VR11	041-005	3V9 0.5W ZENER
1	B1	043-022	RECTIFIER 2KBP08
5	D1, D2, D3, D4, D5	043-004	DIODE BYT11-1000
1	T2	046-002	TRANSISTOR BC327
2	T1, T3	046-003	TRANSISTOR BC337
1		040-040	IC H11A1-Z QUALITY TECHNOLOGY
1		050-021	10WAY CON MOLX F/L .156" 5238
1		050-017	5WAY CON MOLX F/L .156" 5238
1		051-053	FUSEHOLDER PCB MTG 20mm
1		078-002	FUSE 1A SLO BLO 20mm
1		070-012	FUSECOVER 20mm FH2H



## Section 3

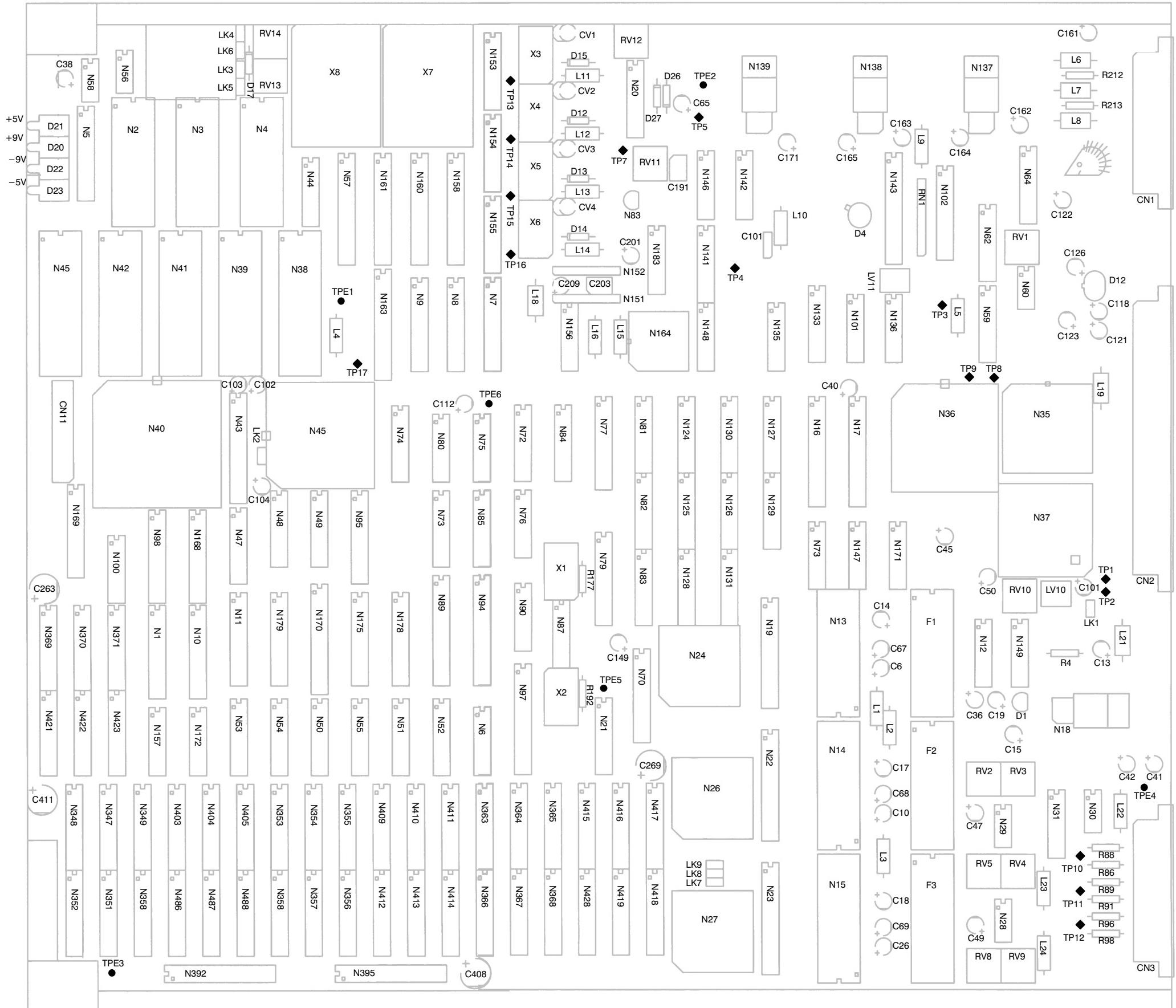




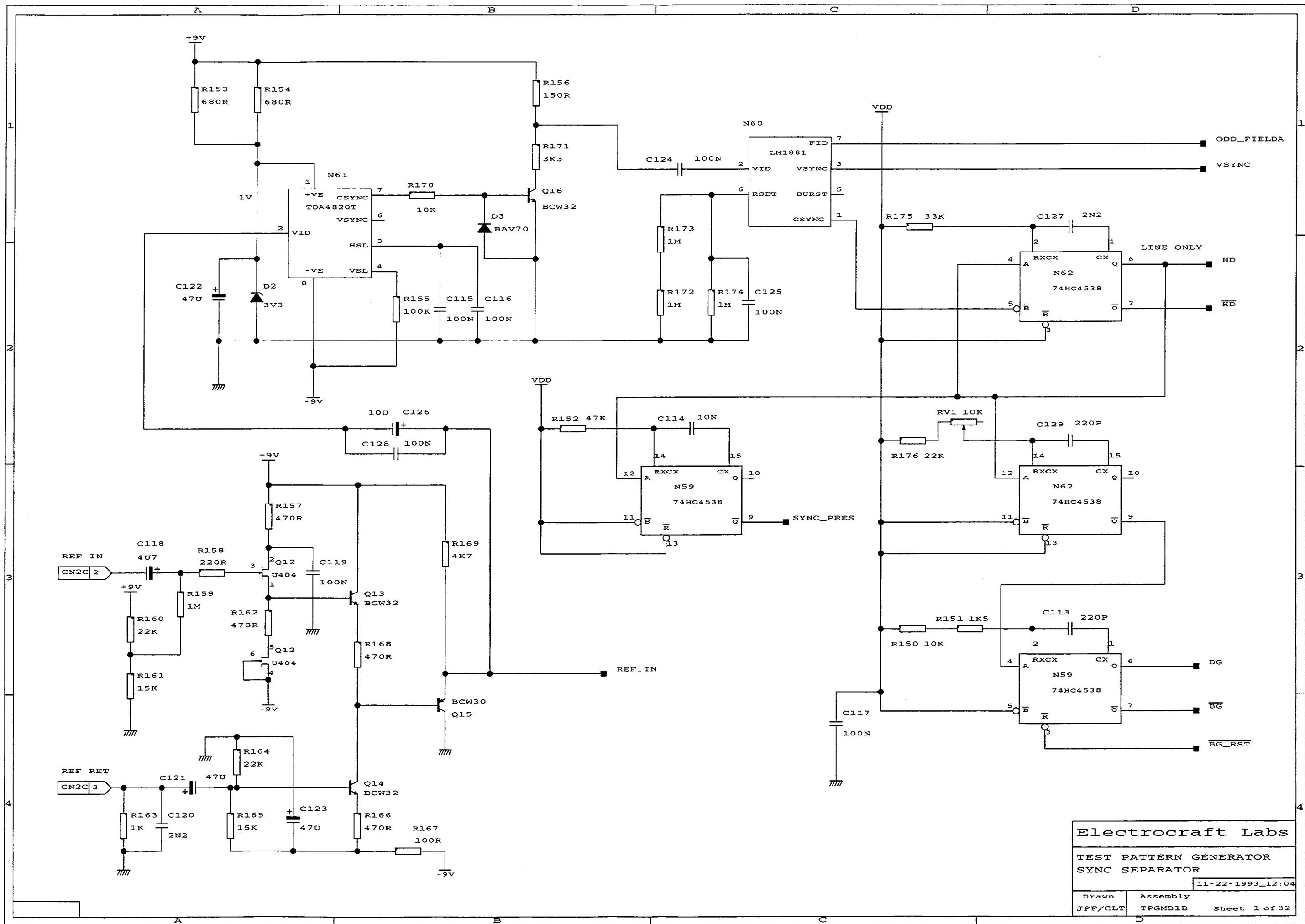
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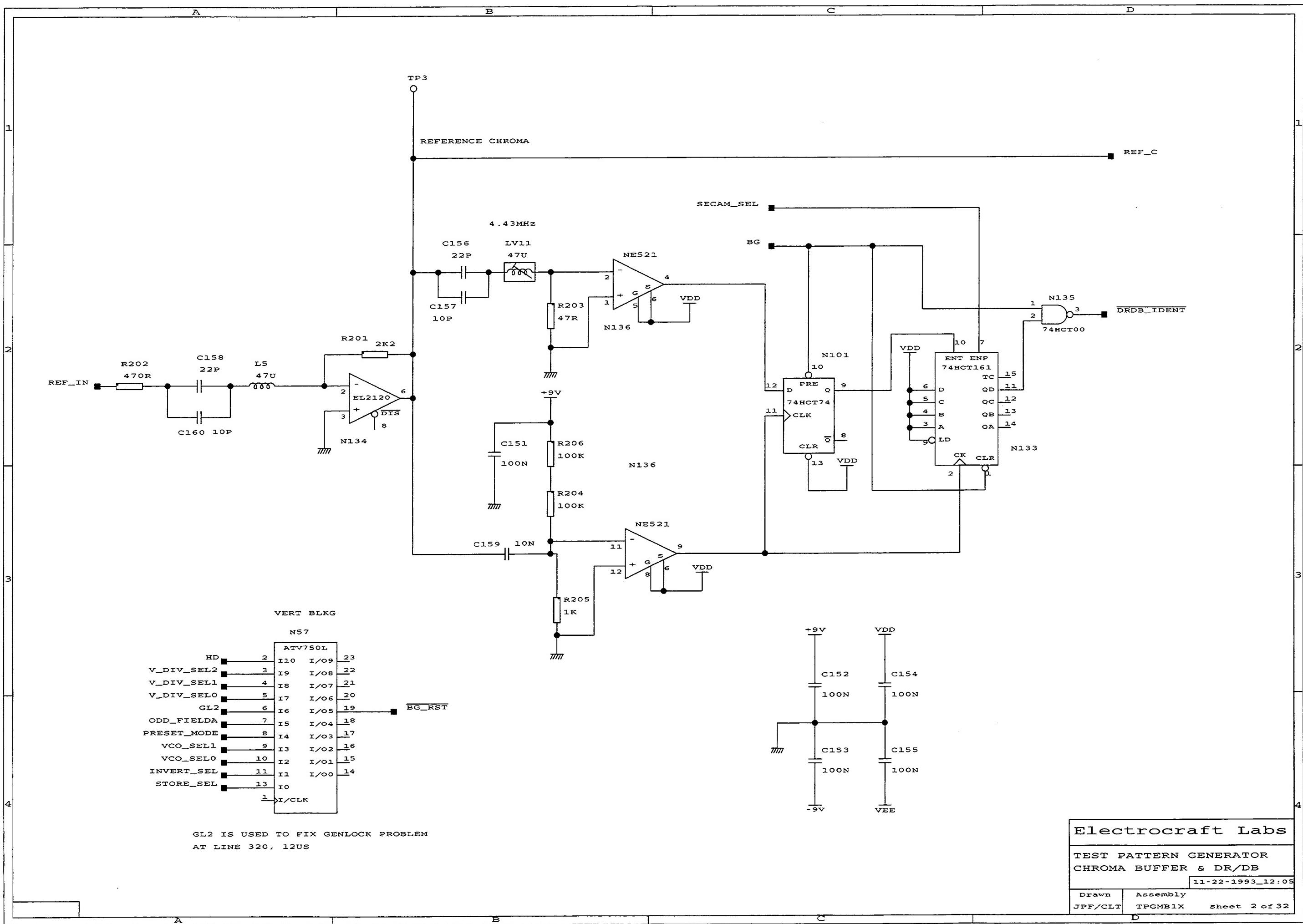
# **Diagrams/Circuit Board Illustrations**

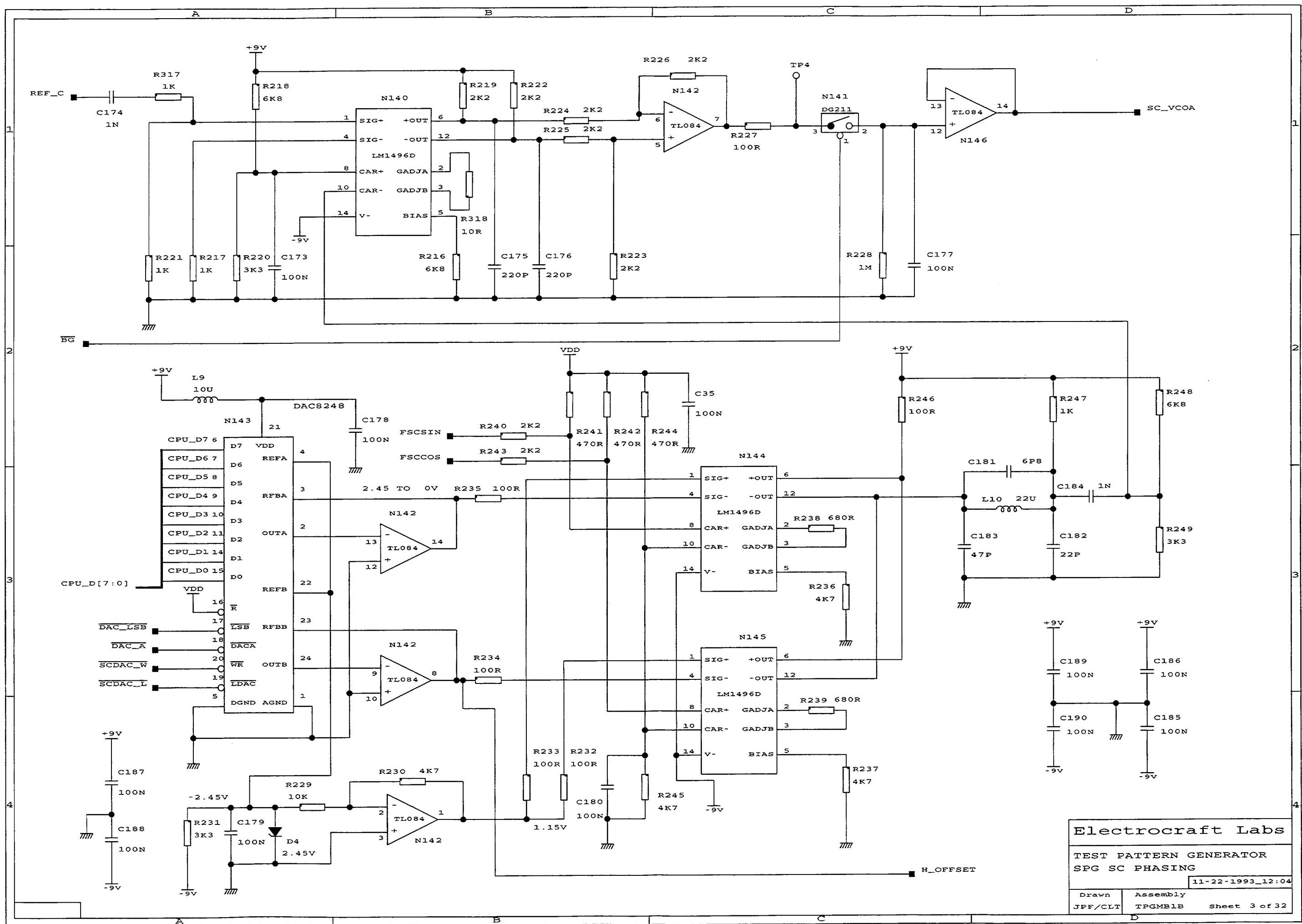


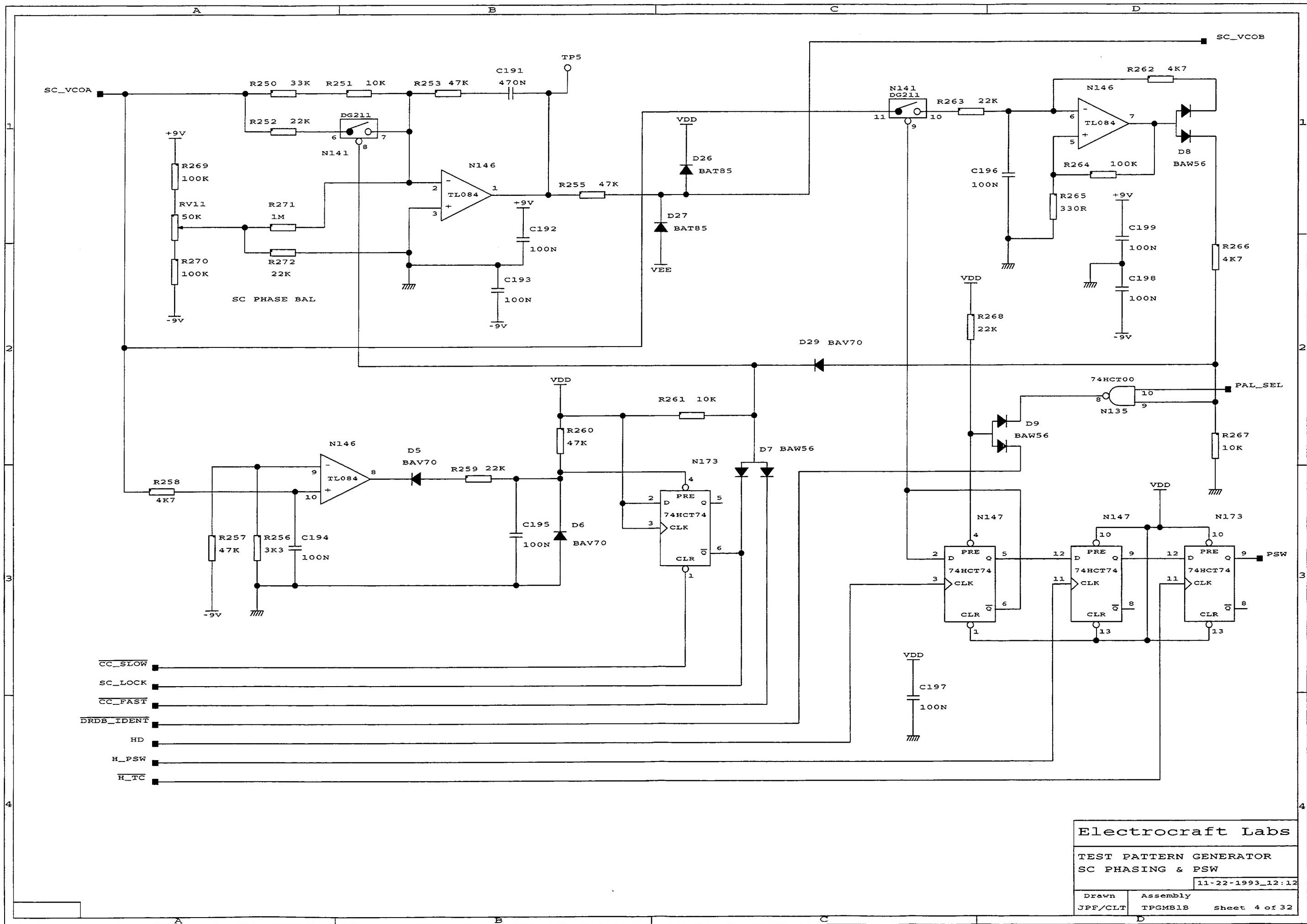


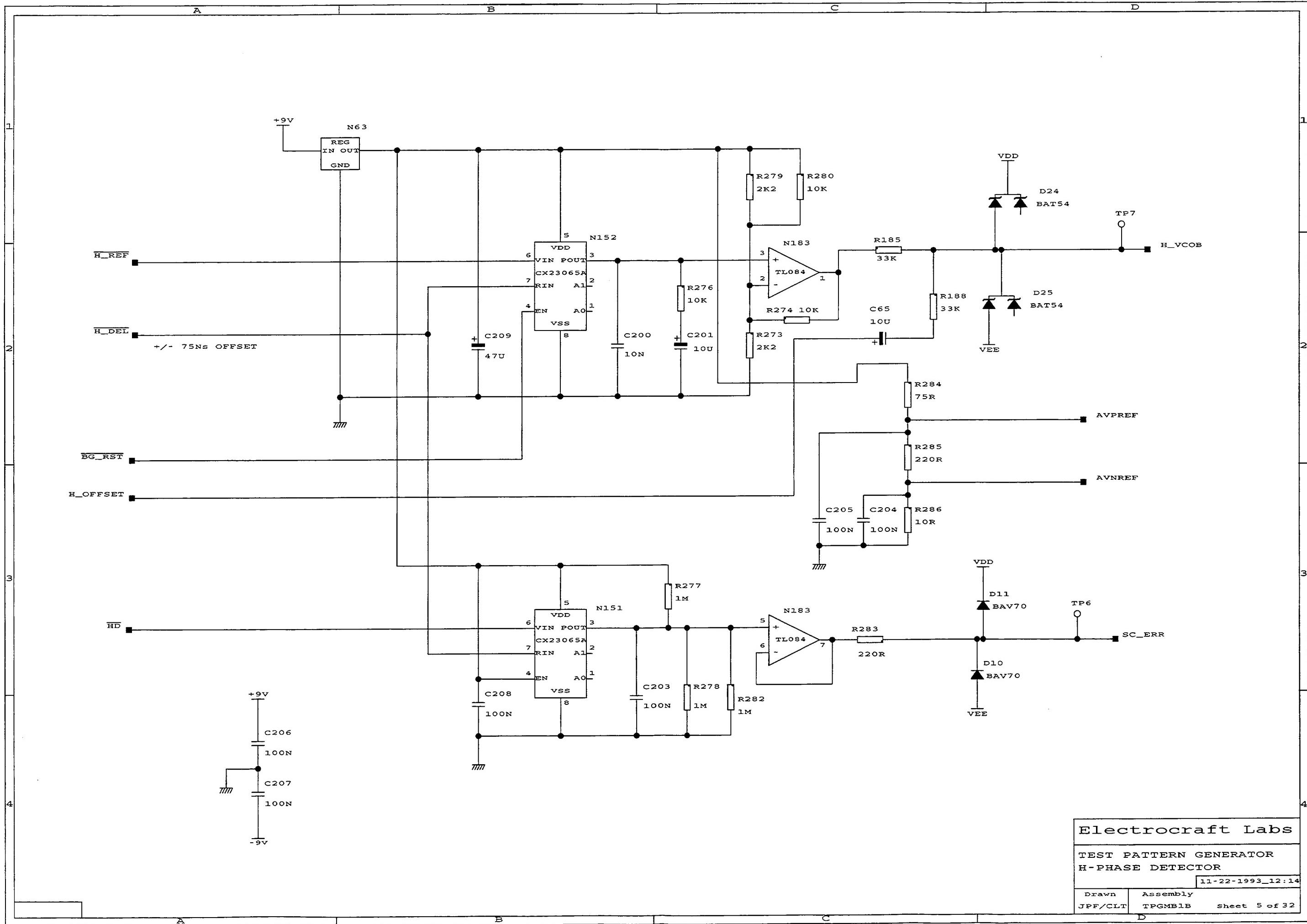
Test Pattern Generator Board

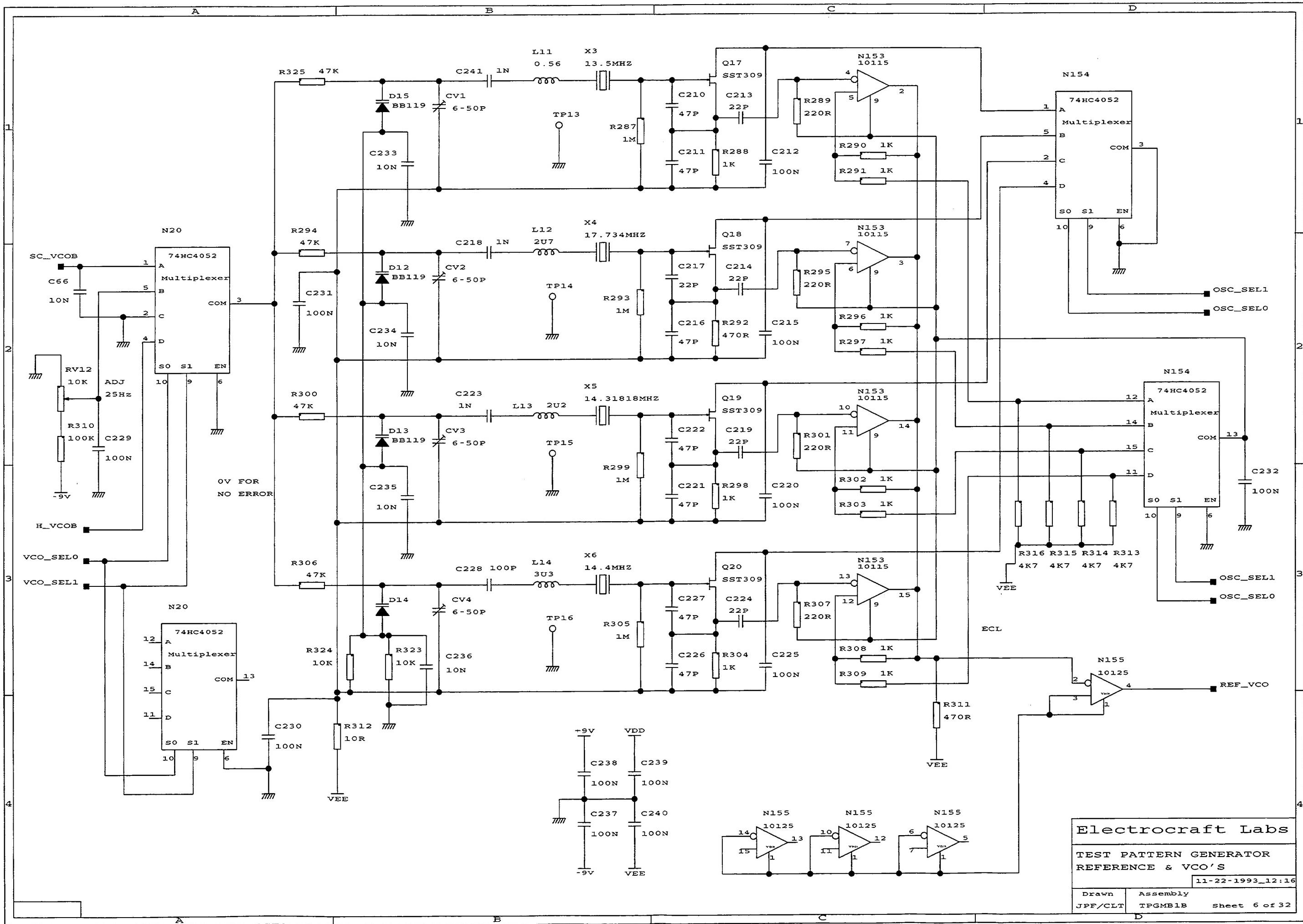


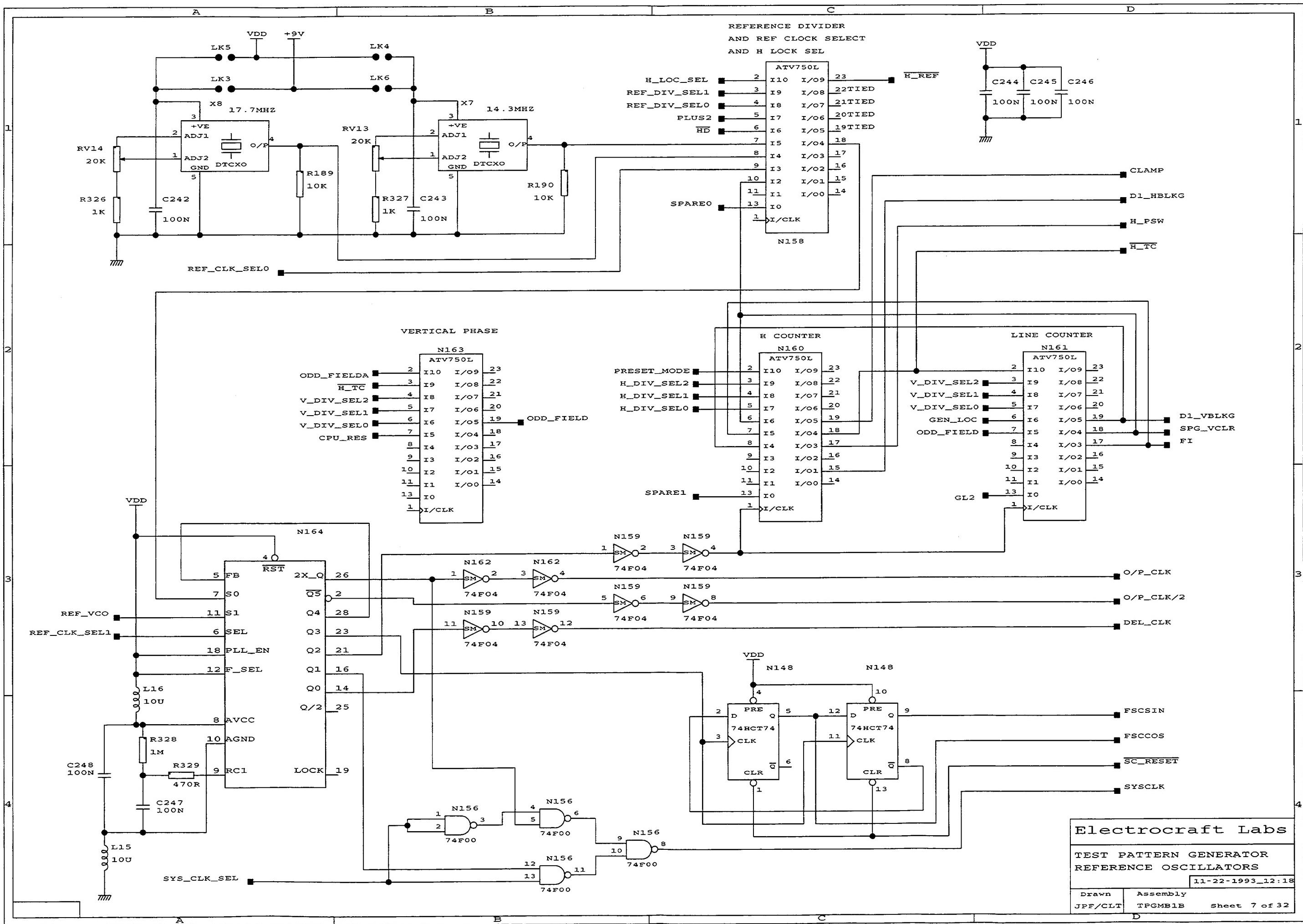


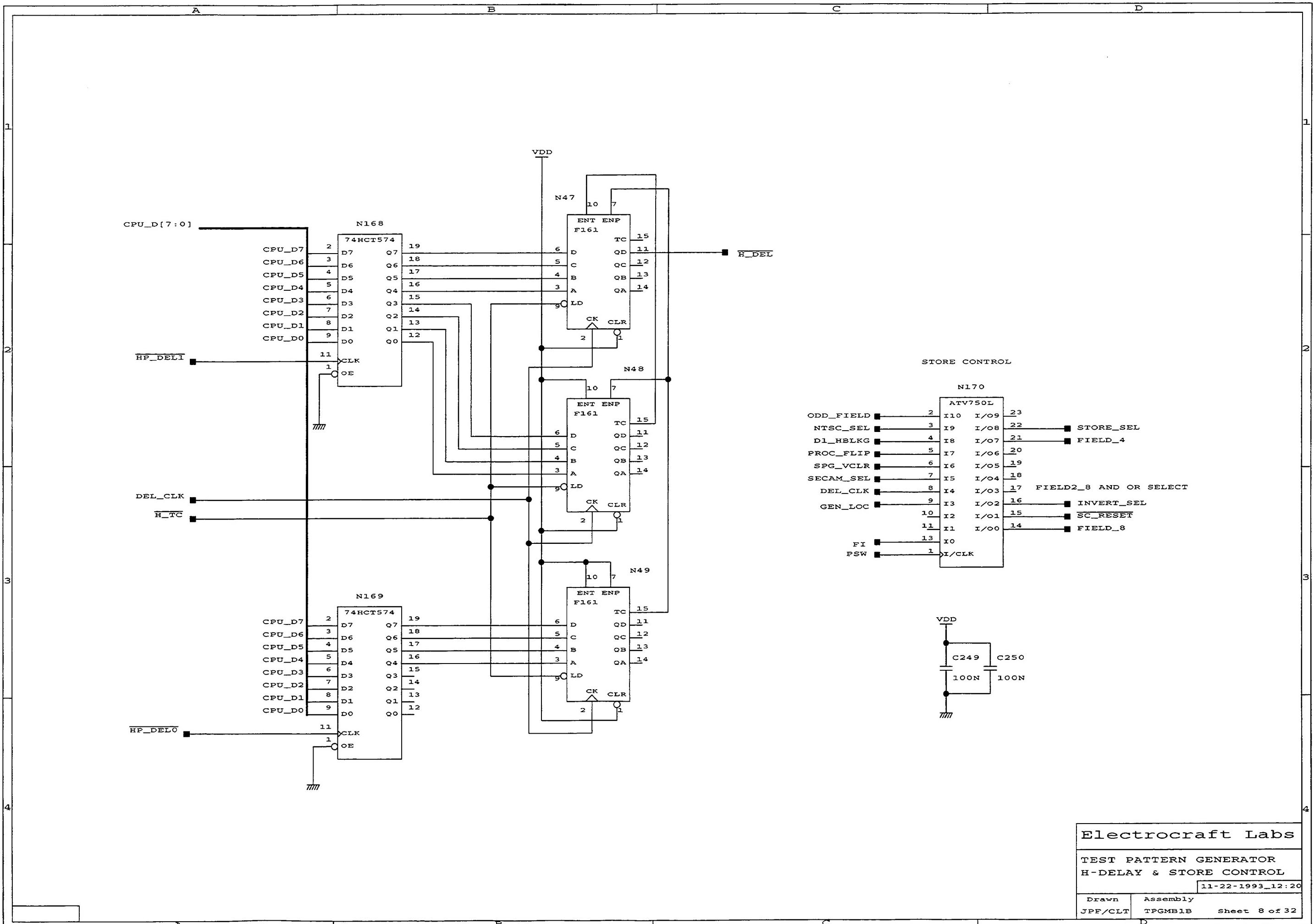


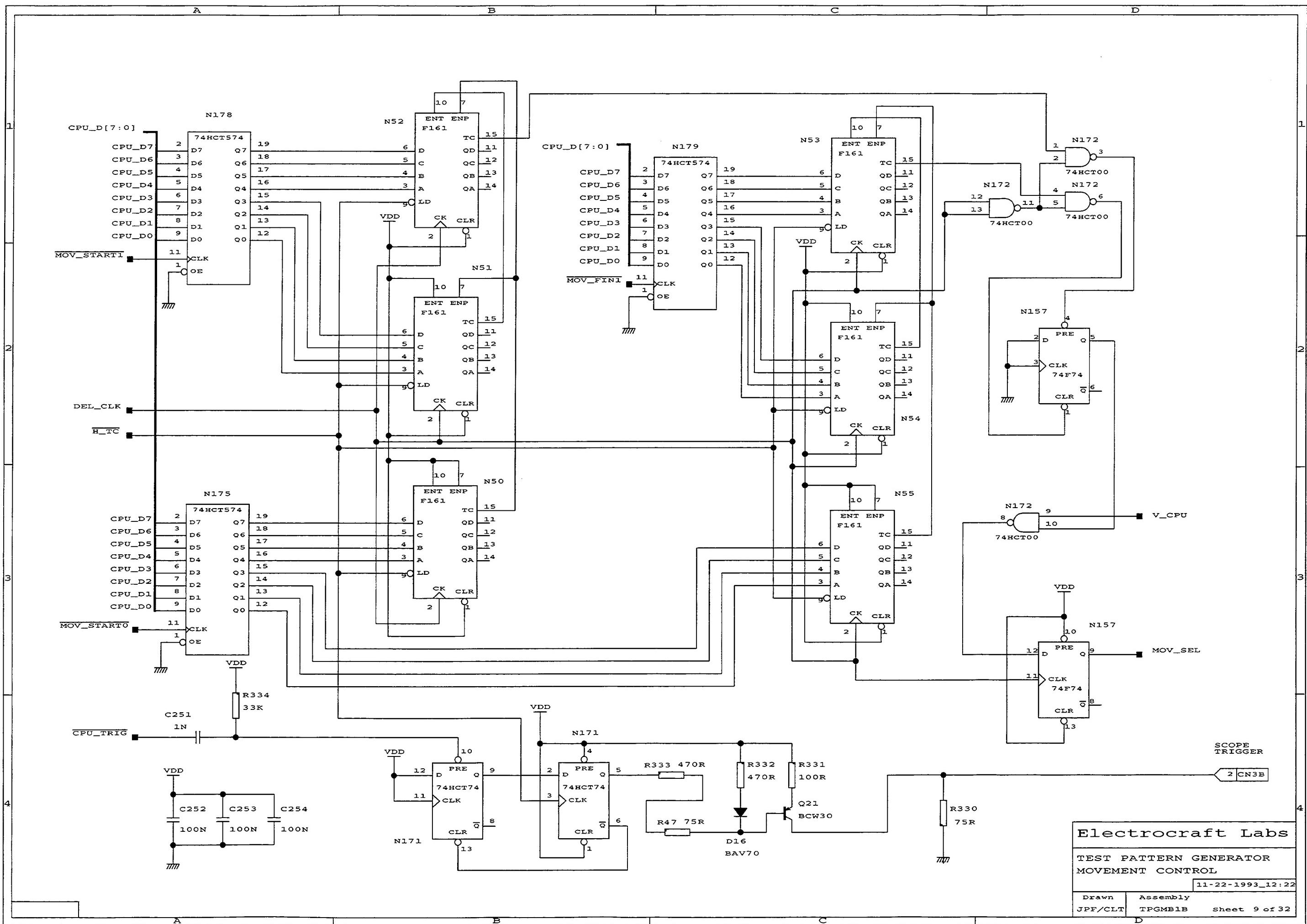


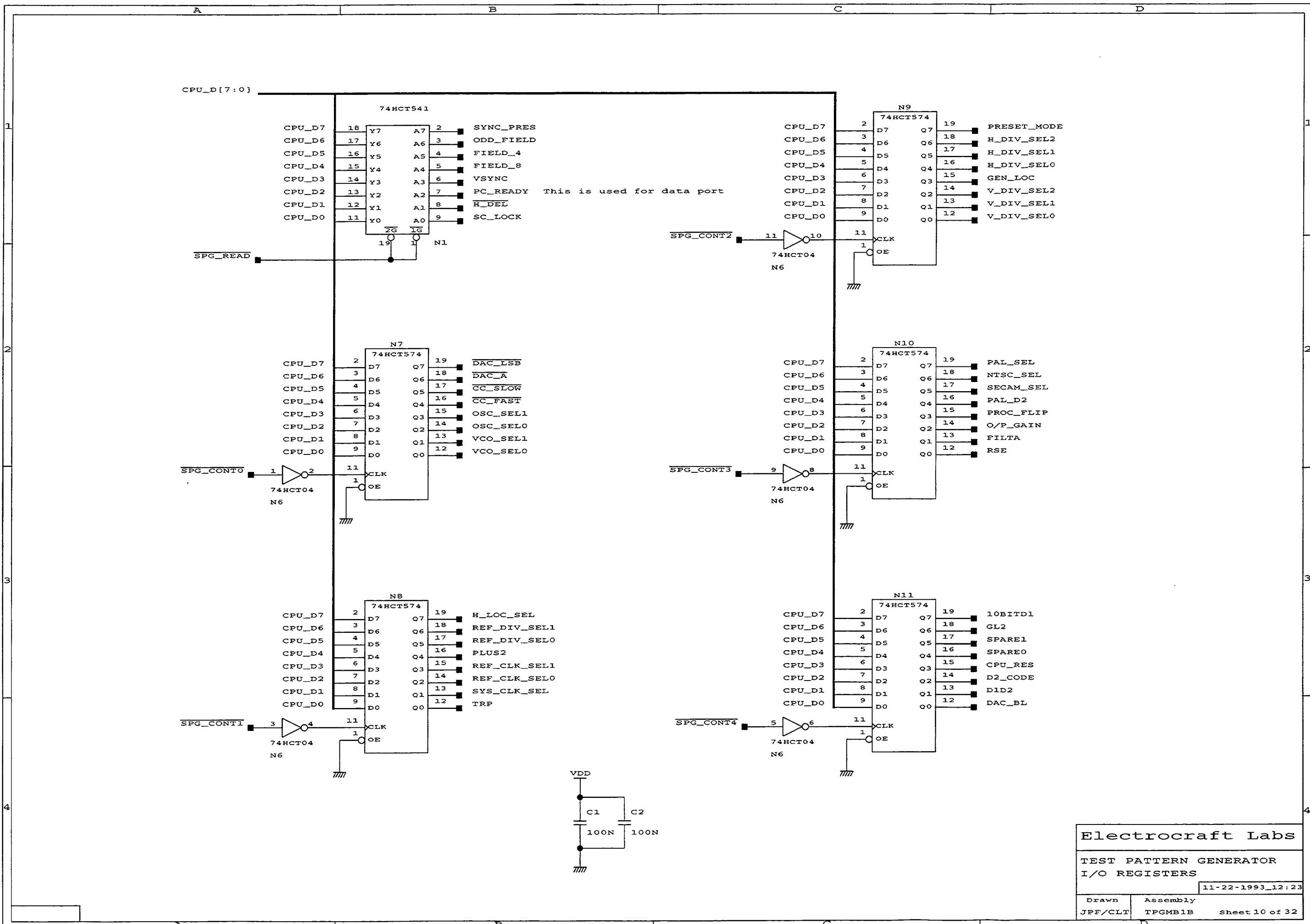


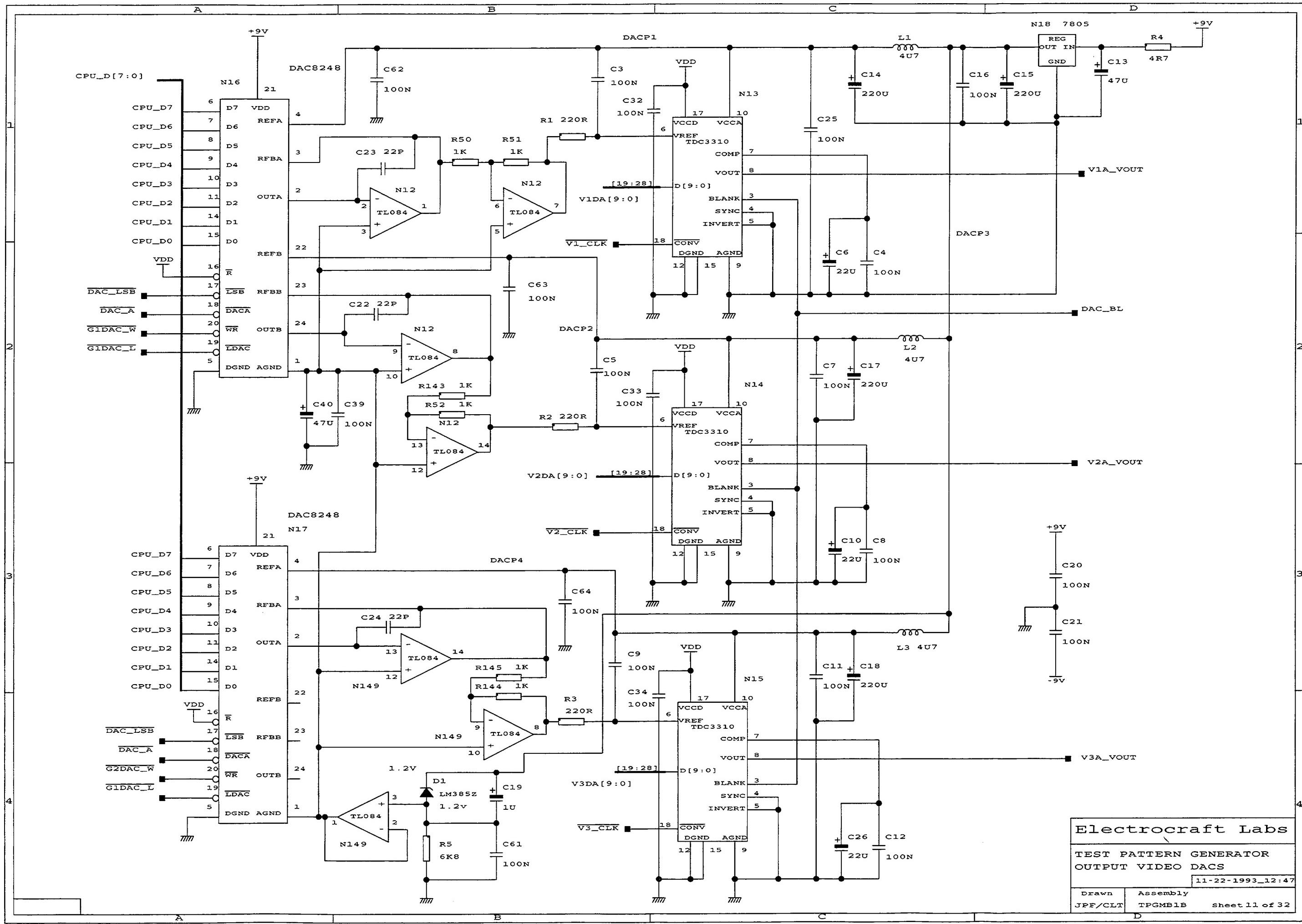


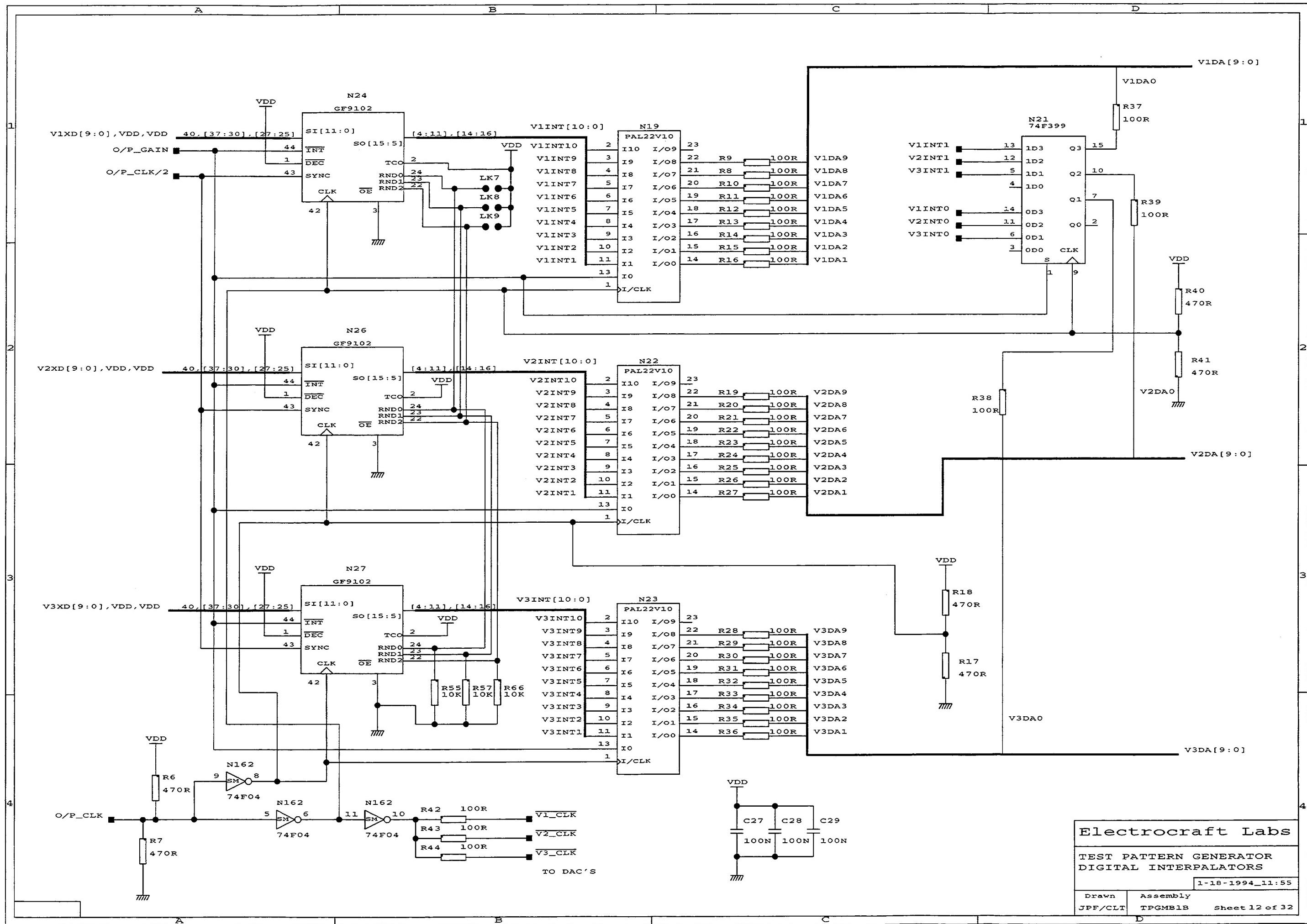


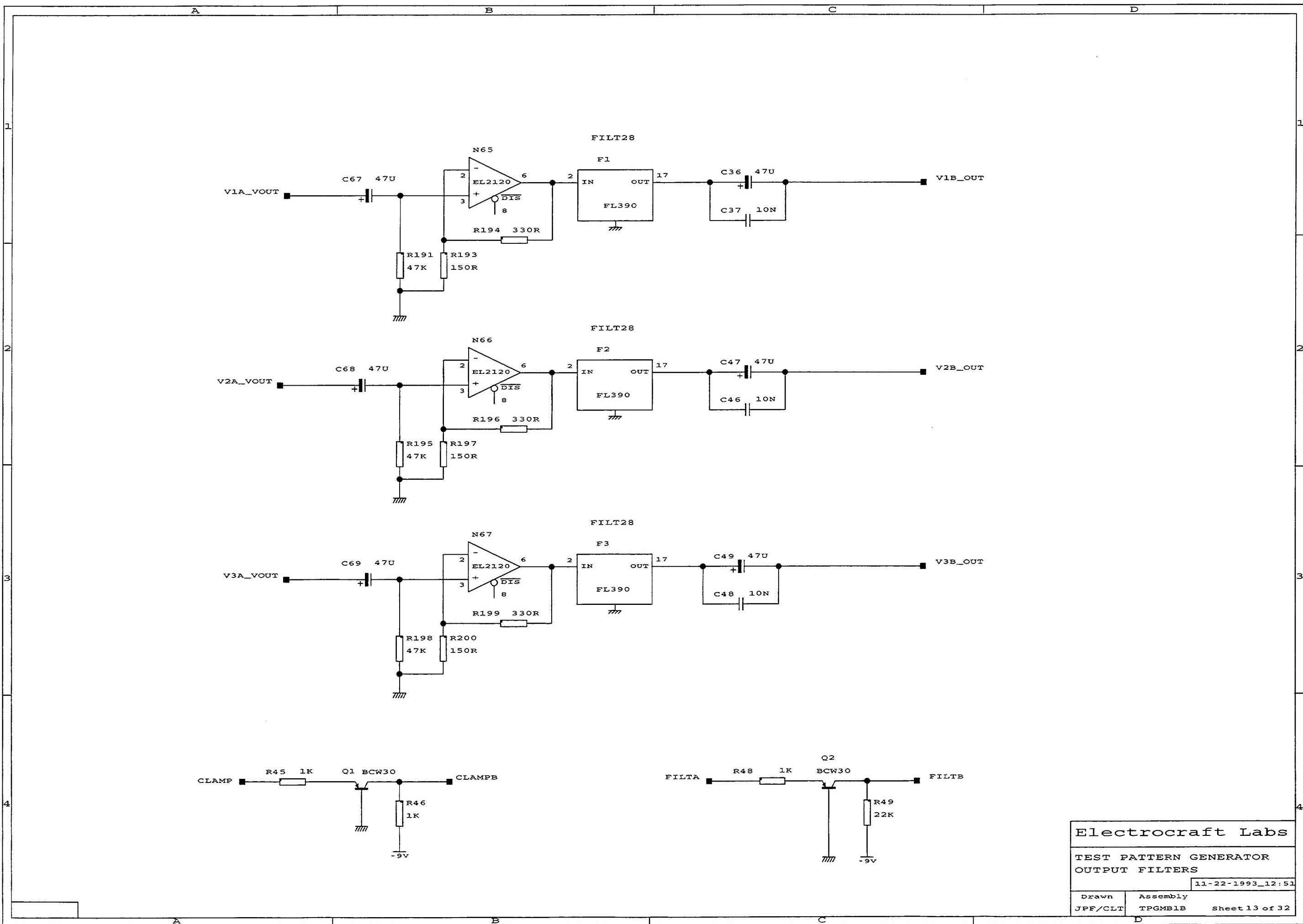


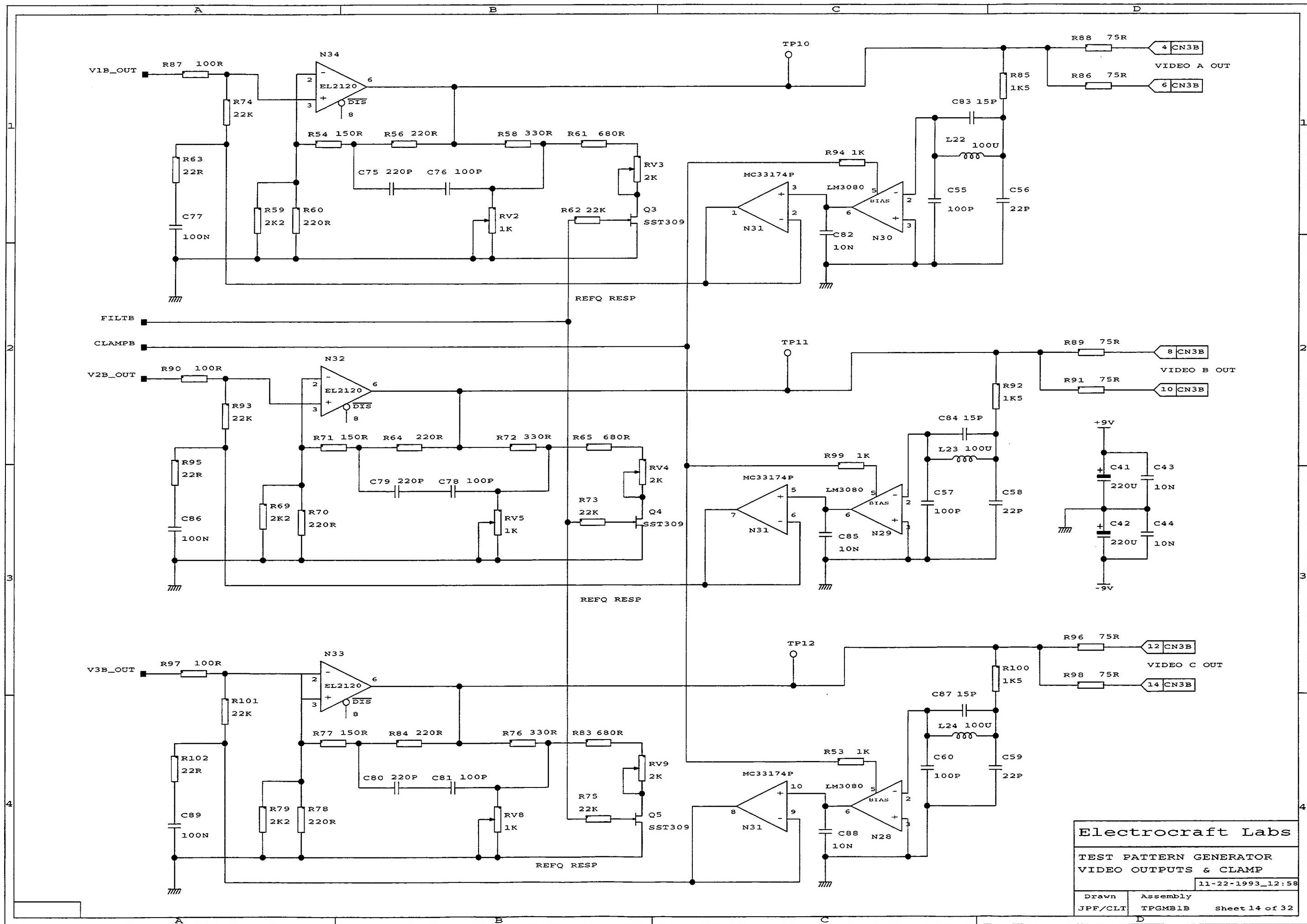


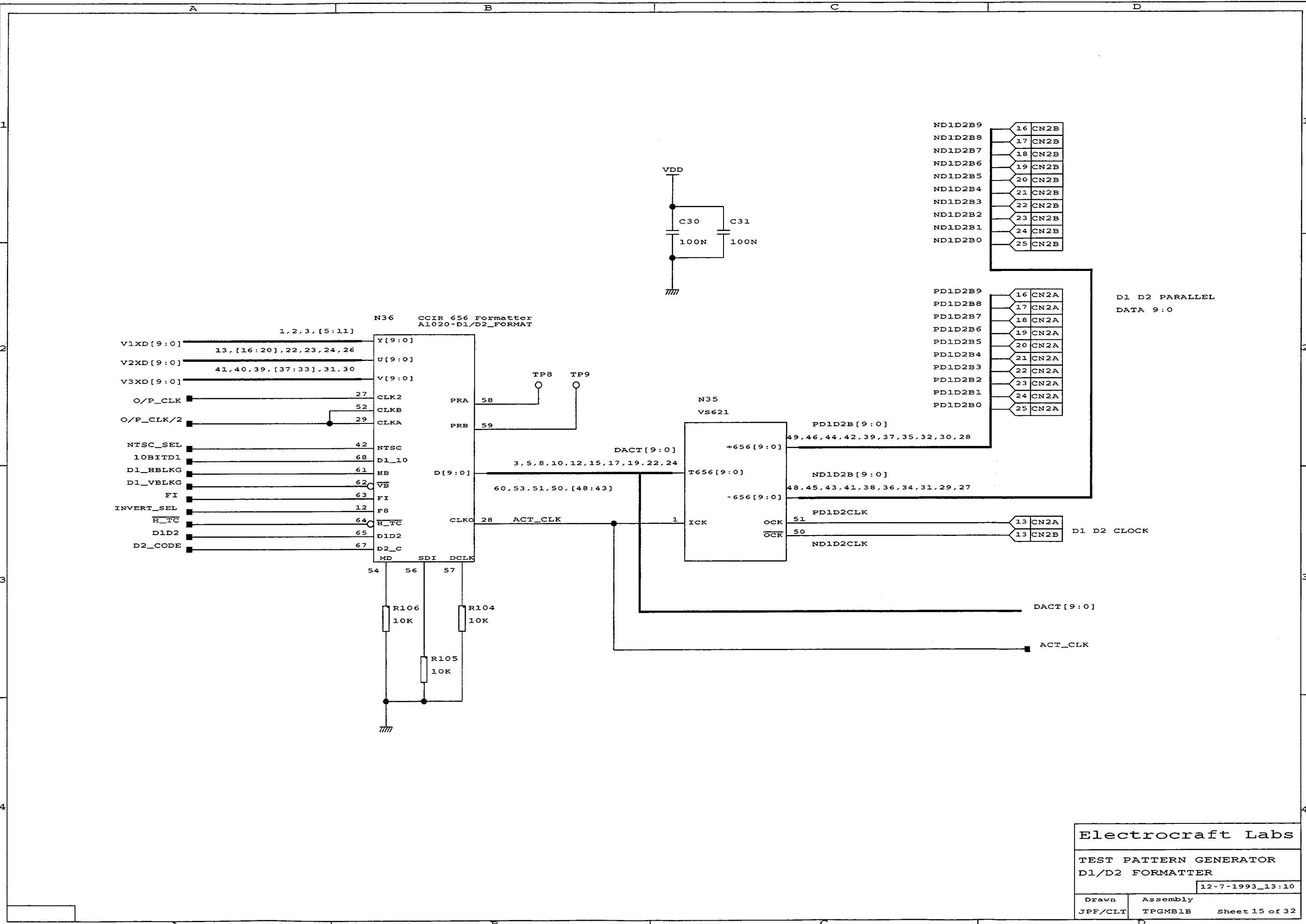


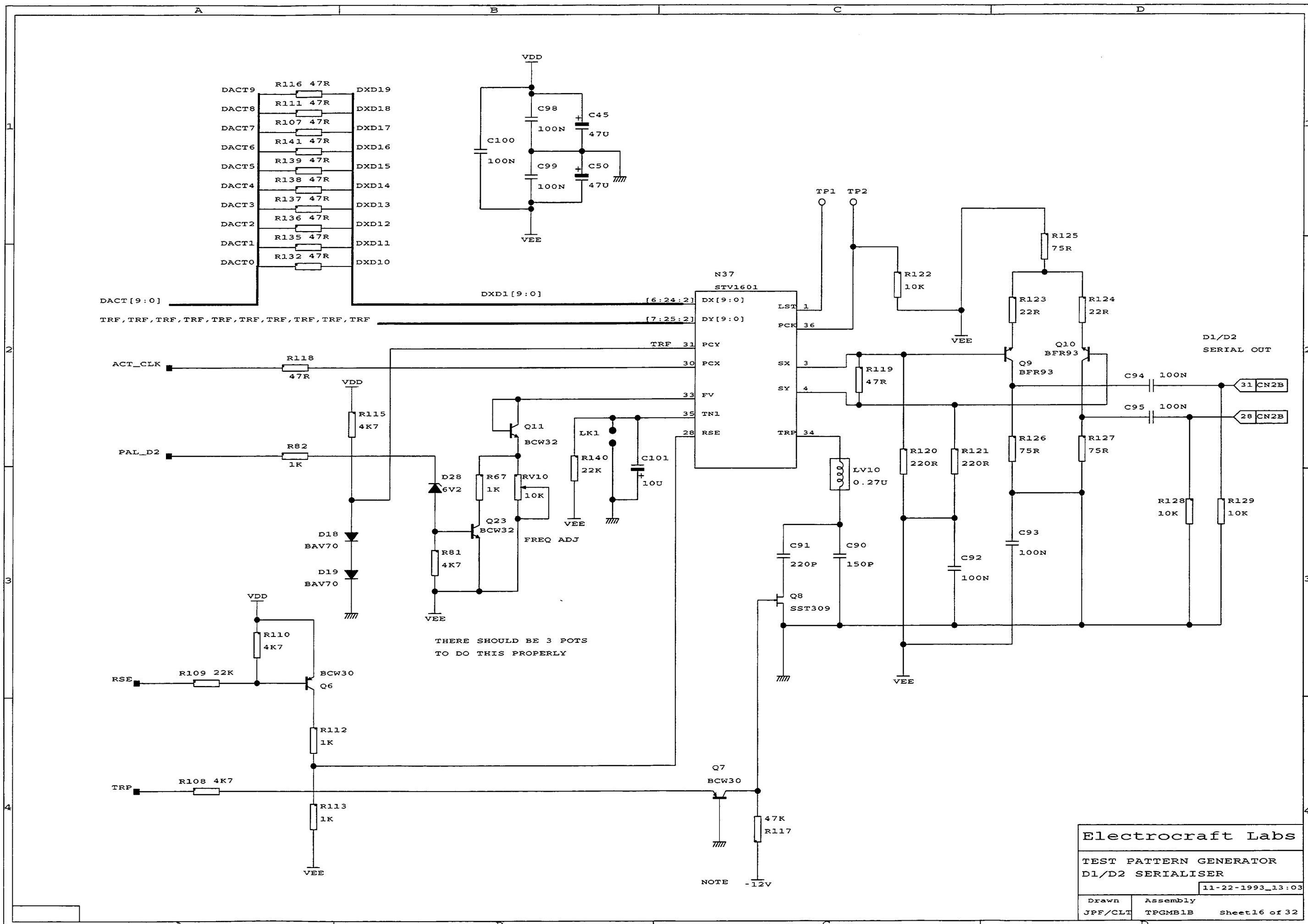


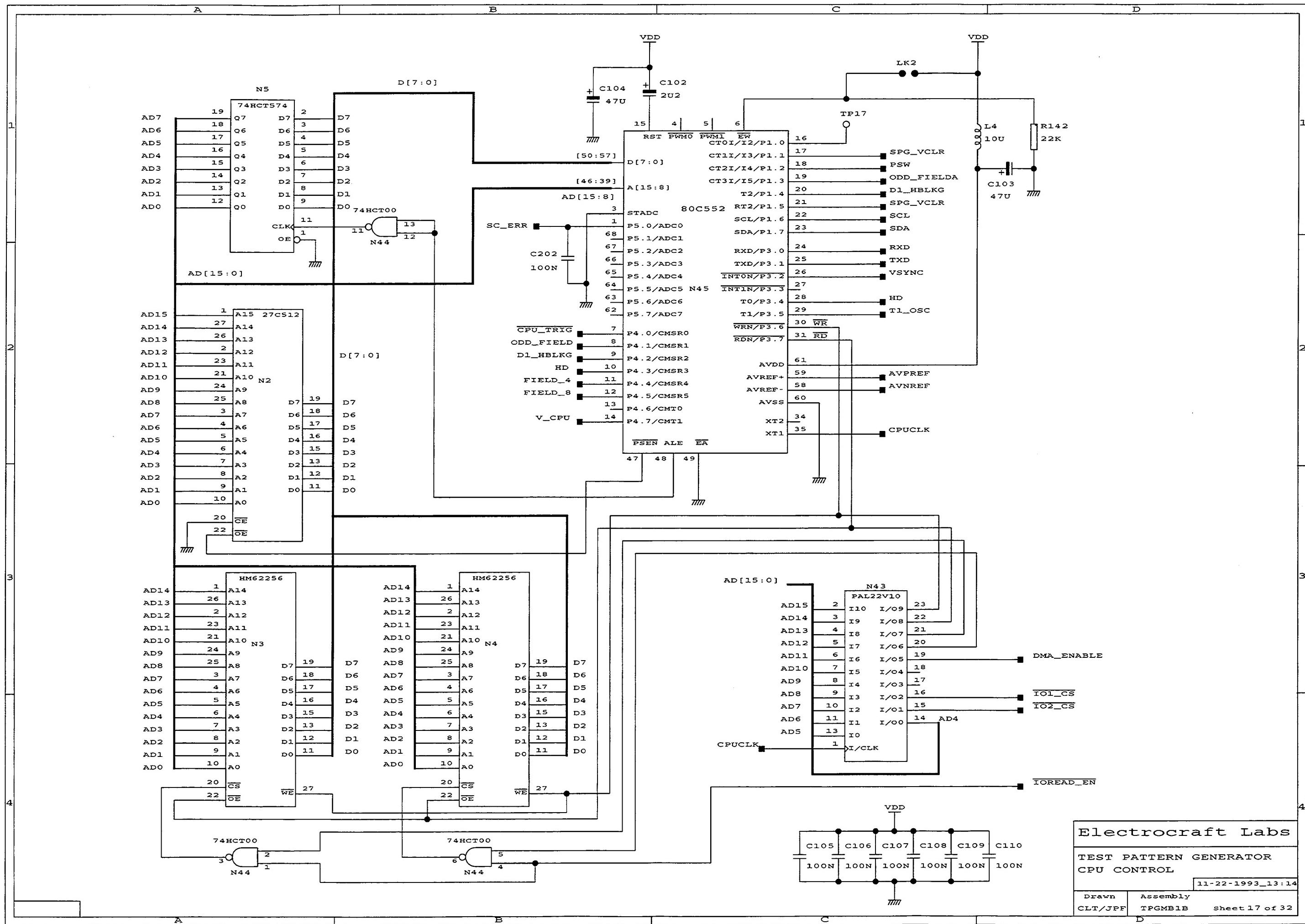


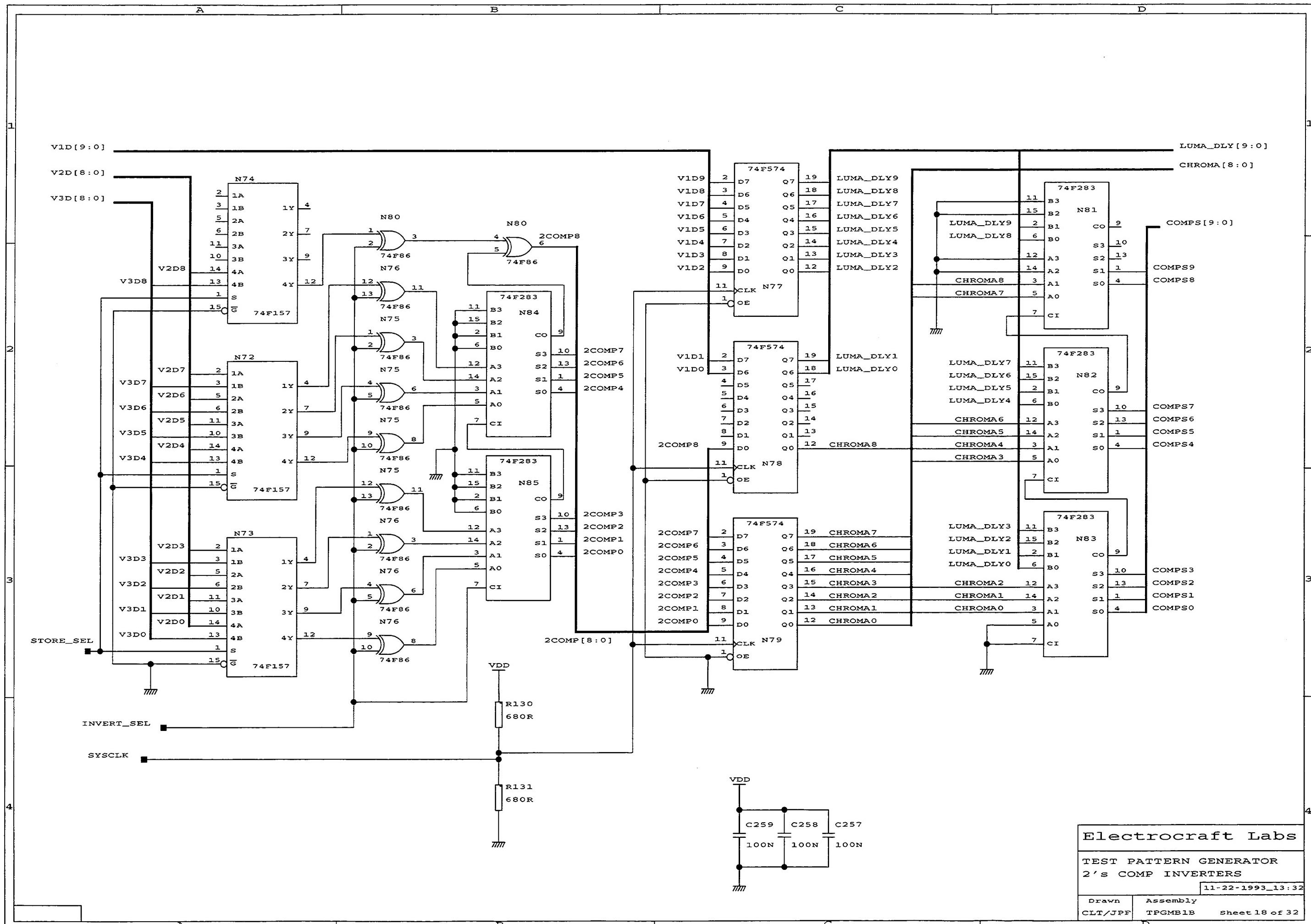


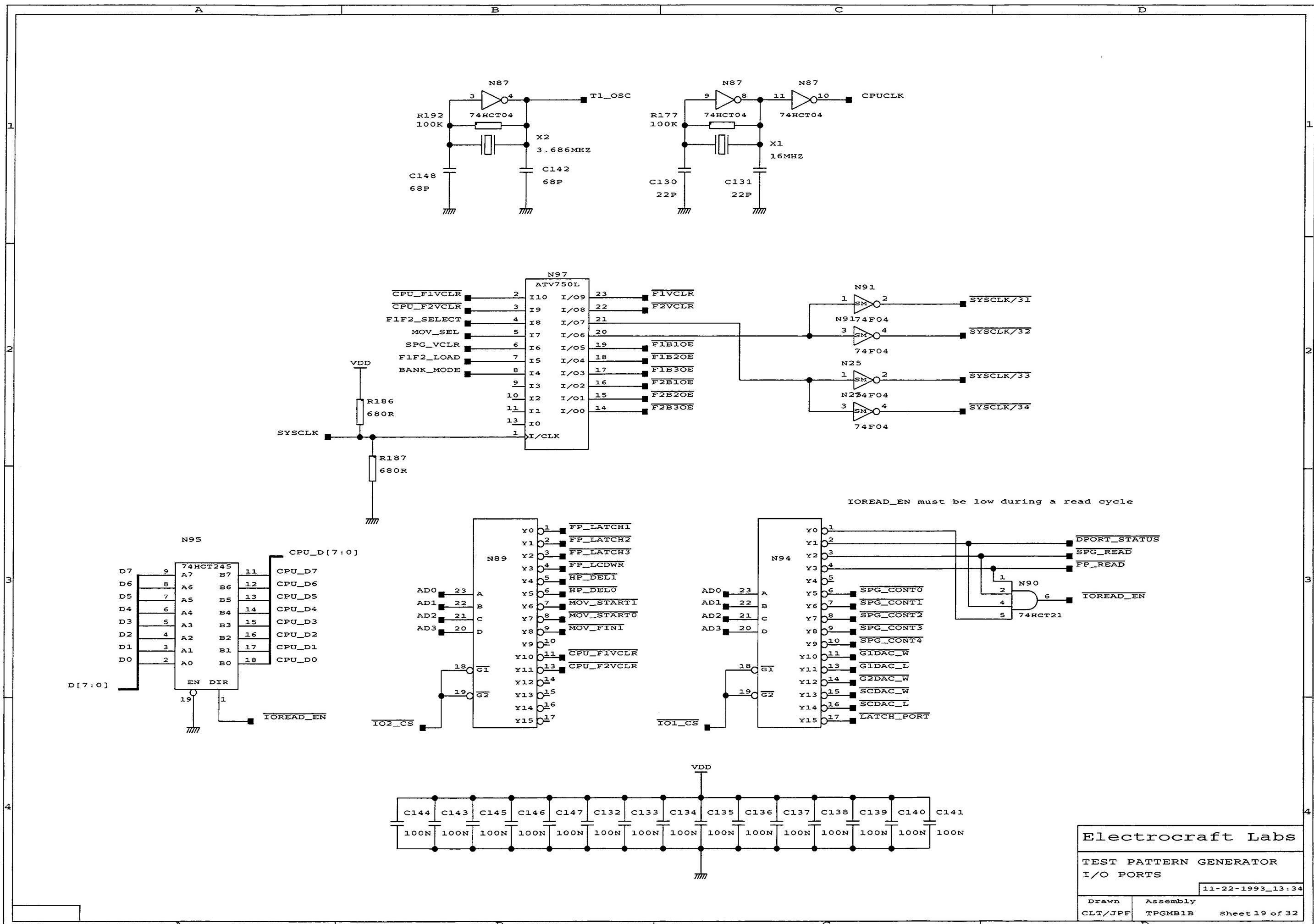


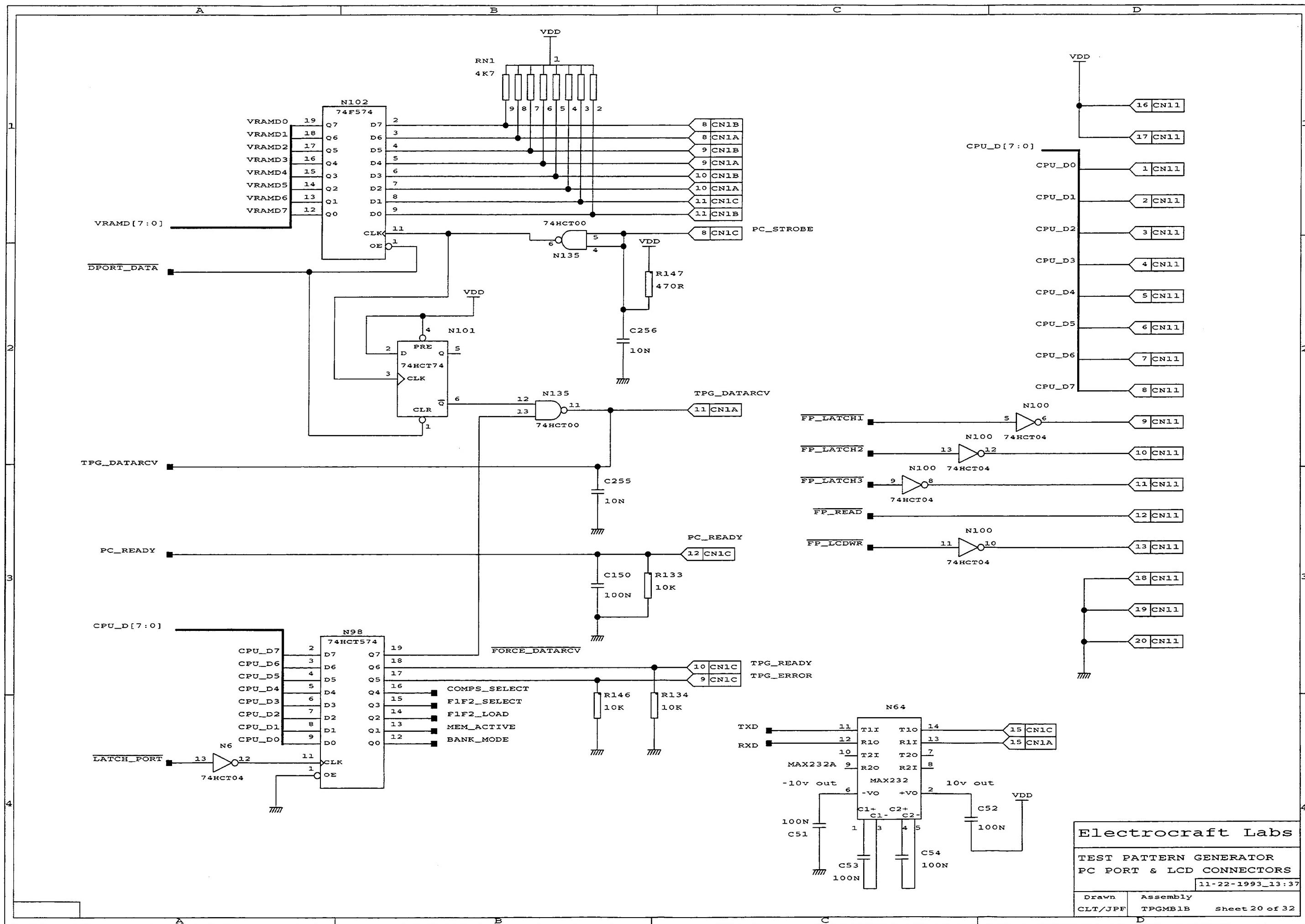


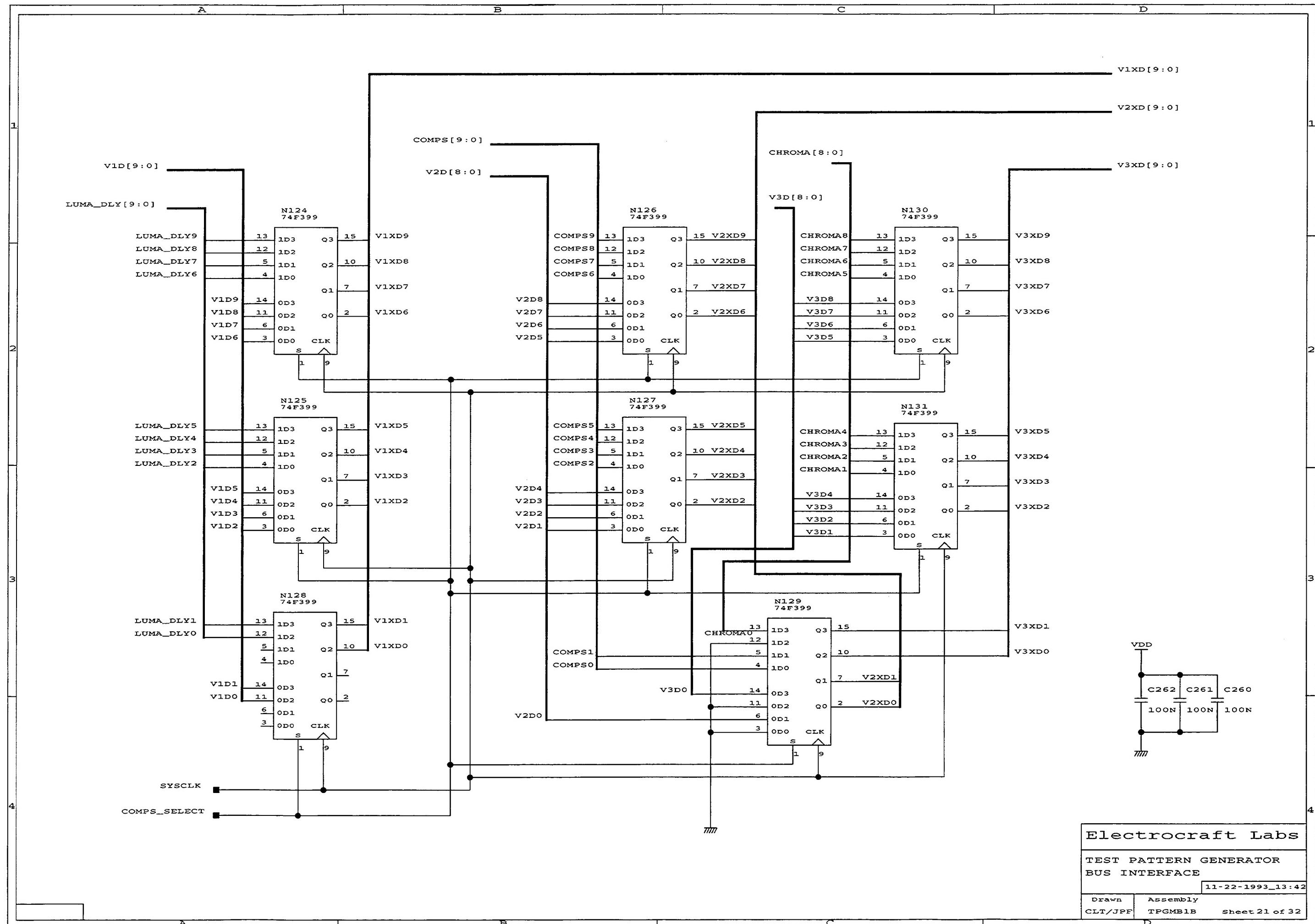


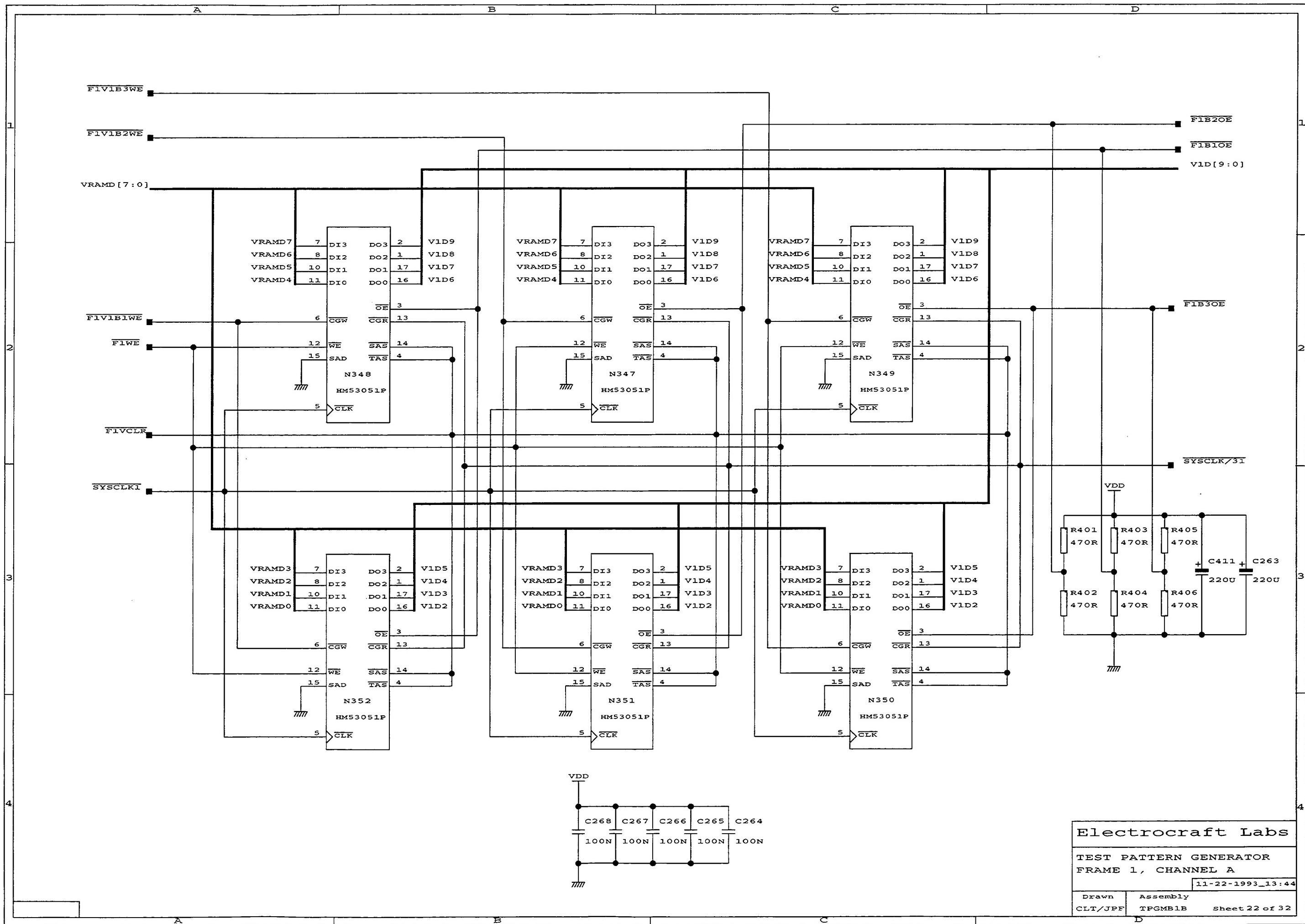


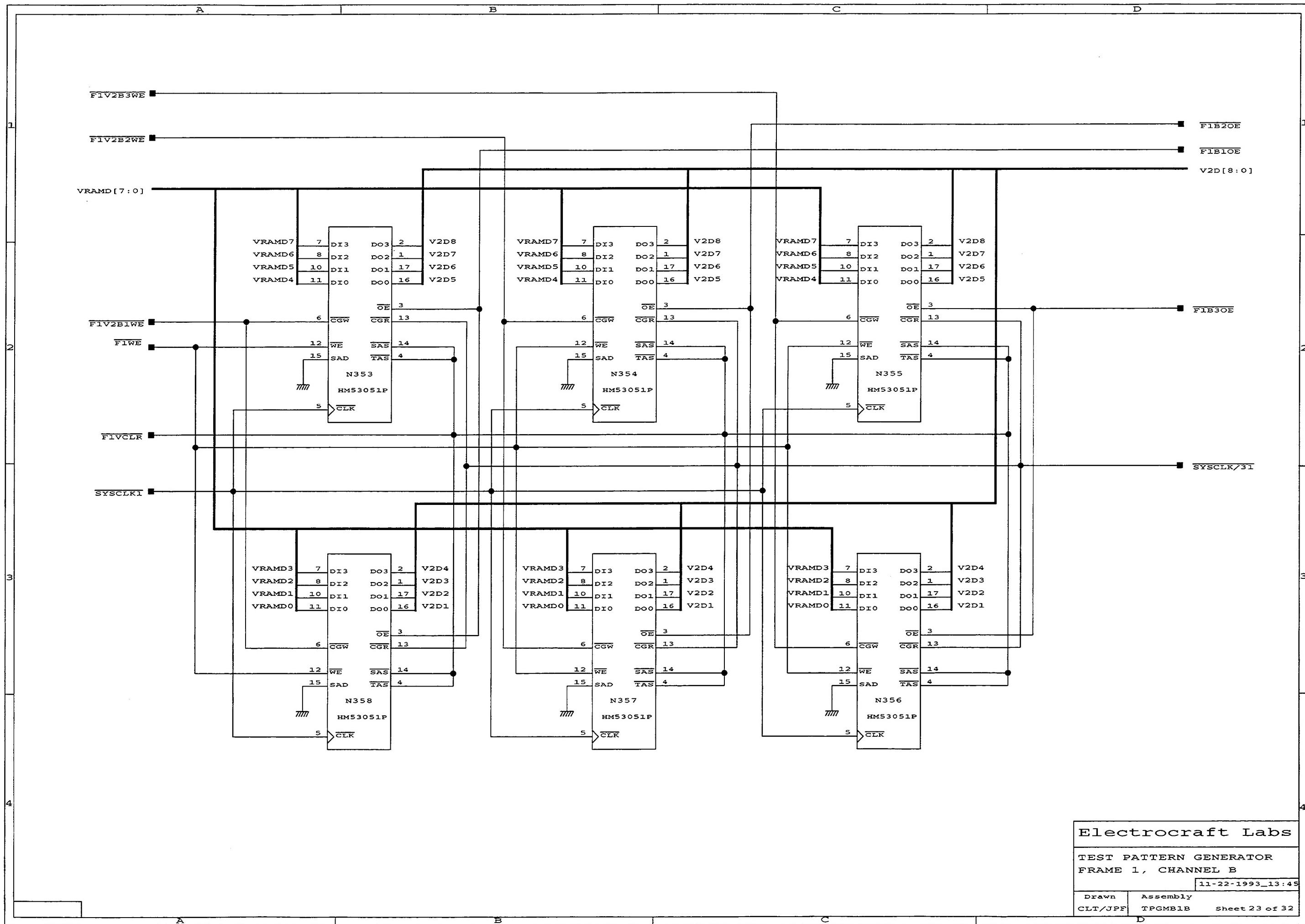




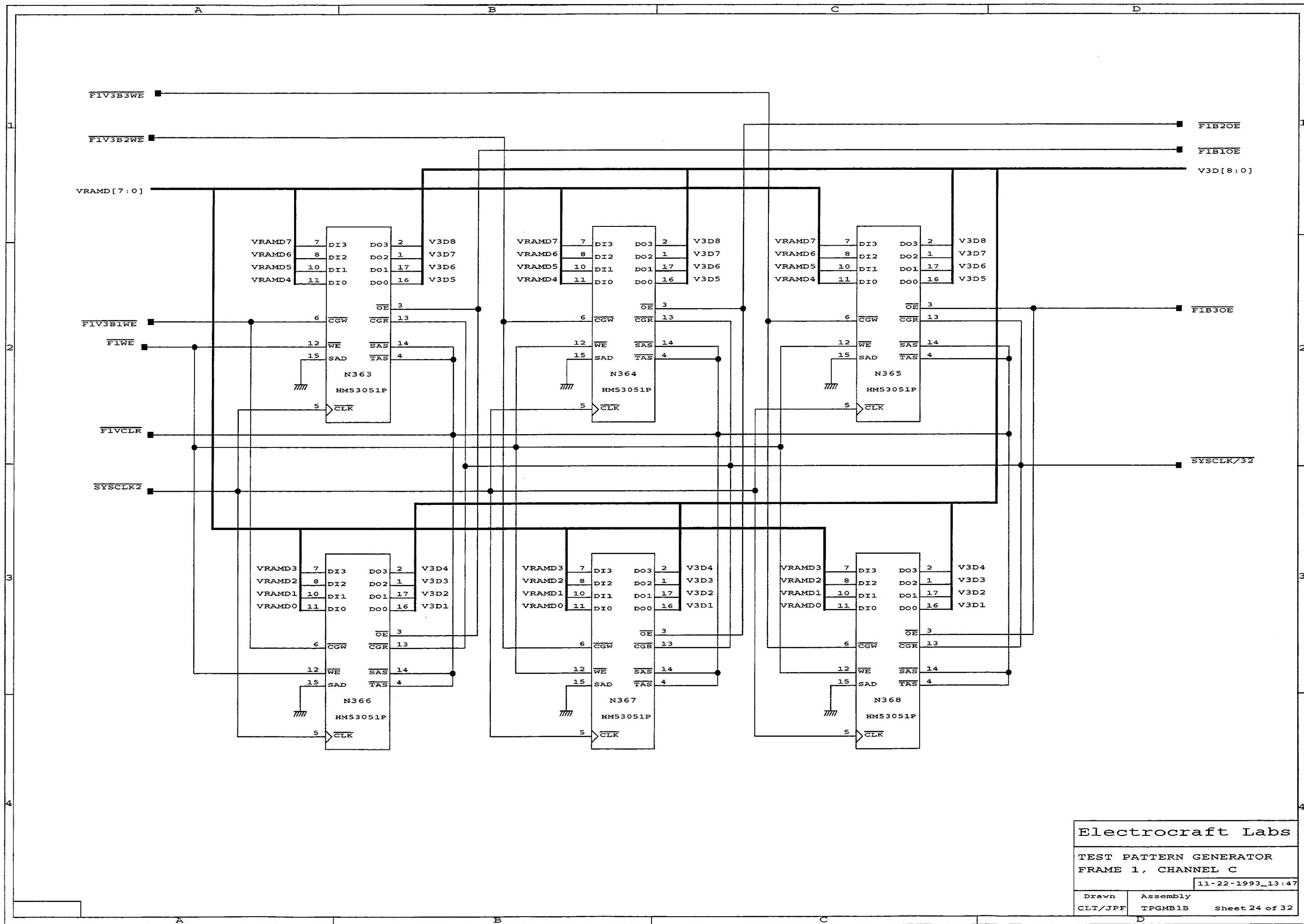


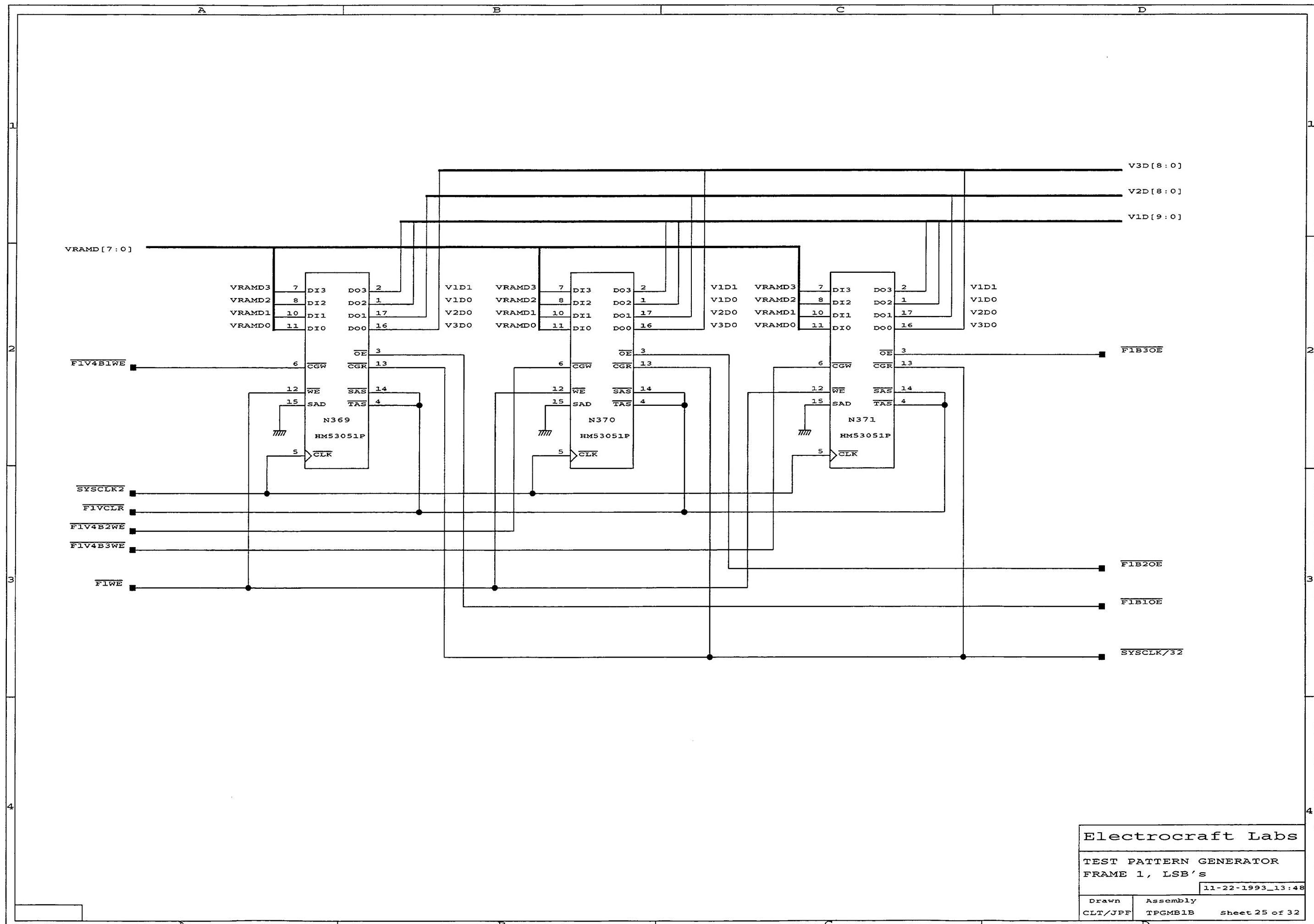






Electrocraft Labs	
TEST PATTERN GENERATOR	
FRAME 1, CHANNEL B	
11-22-1993_13:45	
Drawn CLT/JPF	Assembly TPGMB1B
Sheet 23 of 32	





Electrocraft Labs	
TEST PATTERN GENERATOR	
FRAME 1, LSB's	
11-22-1993_13:48	
Drawn CLT/JPF	Assembly TPGMB1B
Sheet 25 of 32	

